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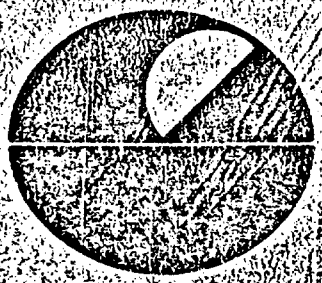
SITE DEVELOPMENT INVESTIGATION
SEAVIEW SQUARE
OCEAN TOWNSHIP, NEW JERSEY



WOODWARD-GARDNER & ASSOCIATES, INC.

CONSULTING ENGINEERS AND GEOLOGISTS

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2, 3, 7

Goodrand & Gardner November 1974

performed at request of Goodmon Company on 132 acre site

Geologic Setting

higher elevation - Cohansey Sand formation

lower elevation - Kirkwood Formation exposures of Shark River Marl expected to be encountered beneath Kirkwood

Site Conditions

~½ moderately wooded south east corner
remainder - dissected plateau ~40ft above pub. road & refuse

Subsurface

test borings & seismic sounding
most proposed building areas underlain by refuse
fine grained natural soils encountered beneath fill
granular soils found surrounding fill
refuse fill was probably dumped on top of ground surface & covered over

Groundwater

gradient of groundwater flow from N + S across site
groundwater w/in landfill polluted

General Considerations

underlying natural soil
methane gas poisonous to vegetation gas migration barrier necessary
best close to fill as possible
venting systems - gravel filled wells or perforated main pipe

Leachate

leachate production function of amt of water available to refuse fill
as water added to refuse, moisture content ↑ as until
here leachate response expected to be in direct response to water entering fill
① collect leachate that is flowing out
② preventing additional water from entering } both necessary here
where refuse materials to be redeposited install collector drains at site perimeter
and along stream
disposal areas for removed refuse will be provided w/ leachate collector drains
to assure refuse would be below groundwater level

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November 26, 1974
73 P 77

The Goodman Company
2020 Building
2030 Tilghman Street
Allentown, Pennsylvania 18001

Attention: Mr. John T. Decker
Vice President

SITE DEVELOPMENT INVESTIGATION
SEAVIEW SQUARE
OCEAN TOWNSHIP, NEW JERSEY

Gentlemen:

We are pleased to present herein our report of the Site Development Investigation that was conducted for the proposed Seaview Square in Ocean Township, Monmouth County, New Jersey. This investigation was initiated by your acceptance of our Proposal of August 7, 1973.

This report presents our findings, conclusions and recommendations for the site development, building foundation design and construction, and other aspects of the shopping mall that are influenced by the geotechnical conditions. The conclusions presented in our interim reports of September 21, 1973 and February 12, 1974 are amplified herein.

Samples of the subsurface materials that were taken from the test borings were brought to our laboratory for inspection and testing. These samples will be discarded after a period of three months unless other instructions are received.

We appreciate the opportunity to be of service to you on this project. Please call on us if we may provide further assistance during the final design and construction of Seaview Square.

Very truly yours,

WOODWARD-GARDNER & ASSOCIATES, INC.

Richard E. Mabry, P. E.

REM/b

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SITE DEVELOPMENT INVESTIGATION
SEAVIEW SQUARE
OCEAN TOWNSHIP, NEW JERSEY

Report to:

THE GOODMAN COMPANY
Allentown, Pennsylvania

WOODWARD-GARDNER & ASSOCIATES, INC.
Plymouth Meeting, Pennsylvania

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SYNOPSIS

The geotechnical investigation reported herein was made at the request of the Goodman Company in connection with the proposed Seaview Square Shopping Mall in Ocean Township, Monmouth County, New Jersey. This investigation was coordinated with Evantash-Friedman Associates the, project architects, and Ackerman-Ney Associates, the project engineers. The site is located north of Route 66, between Routes 18 and 35 as shown on the Regional Location Plan, Plate 1. A portion of the site is presently being utilized as a municiple trash dump.

This study was performed to investigate site and subsurface conditions, to determine the most suitable means for developing the site and to formulate criteria for the design and construction of the proposed site development and building foundation support. The scope of this investigation included planning, supervision and administration of test boring programs, laboratory testing of representative subsurface samples, research of technical literature and reports pertaining to the site problems, and engineering analyses of all pertinent data obtained. The following text presents and describes the results of this study in three sections:

Section I - Site and Subsurface Conditions,

Section II - Design Considerations and Analyses and,

Section III - Conclusions and Recommendations.

As shown on Plate 2, it is presently proposed to construct an enclosed shopping mall with five major stores in the northern portion of the approximately 132 acre site. The buildings proposed for this develop-

ment will be two-story structures with the lower floor for all structures proposed to be at elevation +44. It is anticipated that column spacings will be on the order of 25 to 35 feet and maximum column loadings will be on the order of 400 kips. Consistent with the existing site topography, the proposed development will entail a significant amount of excavation and filling to achieve a more uniform grade throughout the site and to provide a suitable building pad. It is proposed to achieve grade separations in the parking area through retaining walls and planted slopes.

Based on the investigation and analyses reported herein, it is concluded that it would be technically feasible to develop the proposed Seaview Square site for the construction of a regional shopping mall. Removal of the refuse fill materials from the building area and replacement with compacted load-bearing fill will provide satisfactory foundation support for the proposed buildings. The buildings in the Seaview Square development would thus be totally isolated from the refuse materials which will be placed in a controlled manner in the paved areas or other on-site disposal areas. Proper construction precedures and the inclusion of drainage and venting systems will preclude any adverse environmental effects from the refuse fill materials during and subsequent to site development construction.

SECTION I

SITE AND SUBSURFACE CONDITIONS

The site and subsurface conditions were investigated by means of field explorations at the locations shown on Plate 2. A description of the field investigation program and logs of the test borings are presented in Appendix A together with the results of refraction seismic soundings that were made. The laboratory testing on representative samples is described and the test results are presented in Appendix B. The findings of the site investigations are summarized herein.

1.1 GEOLOGIC SETTING

Regional geologic mapping indicates the higher elevation land within the site vicinity to be characterized by surficial deposits consisting of the Cohansey Sand formation of Tertiary Age. This formation is described as being chiefly light colored sand with clay laminae and lenticular beds of clay and gravel. The lower elevation land is reported to be characterized by surficial deposits of the Kirkwood Formation, also of Tertiary Age. In Monmouth County, this formation is reported to be typically of brown color and to consist of interbedded fine micaceous sand and clay that becomes predominantly clay with increasing depth. In the vicinity of the site there are exposures of the Shark River Marl, an older Tertiary formation that is identified as green sand and clay. Consistent with the geologic sequence, the Shark River Marl is expected to be encountered beneath the Kirkwood Formation.

Isolated deposits of the more recent Cape May Formation of Quaternary Age are also shown to be in the vicinity of the site. These typically occur at lower elevations and are primarily composed of brown sand and gravel.

1.2 SITE CONDITIONS

Based upon field reconnaissances, many of the features of the site conditions are shown on Plate 3. About one-half of the 132 acre site is moderately to heavily wooded with medium size trees and, during the summer months, supports a moderate to heavy growth of underbrush, This portion of the site, primarily in the southeast corner, appears to be nearly level to gently sloping. Surface elevations in this area range from about +10 to about +40. Another wooded area of the site exists in a band several hundred feet wide along the western and southwestern portion of the site. There is a swampy area along the western edge of the site adjacent to the Route 18 embankment. It was reported that during dry weather, springs in this area maintain the flow in the stream traversing the south central portion of the site in a generally west to east direction and eventually into Deal Lake to the east.

Most of the remainder of the site can be described as a dissected plateau extending about 40 feet above the surrounding topography. This higher ground is generally understood to have resulted from materials being placed during the past 20 to 25 years as a commercially operated municiple refuse dump. The approximate limits of this dump, based upon the test boring results reported herein and the field reconnaissance, are shown on Plate 3. The refuse dump was observed to be covered with brown silty gravelly sand that during the summer months supports a moderate growth of weeds. Leachate was observed flowing out from the refuse pile at the locations shown on Page 3.

The site topography blends into the undisturbed higher ground adjoining the northern boundaries of the site. Ground surface elevations in this area are on the order of +90 to +100. Light brown silty gravelly sand was observed at the ground surface and a few trees and some brush and weeds were observed to be growing in this area. Recent excavation on some of the adjacent properties to the north has resulted in ground surface elevations 10 to 20 feet lower than when this investigation was begun.

1.3 SUBSURFACE CONDITIONS

The subsurface conditions in the project site were explored through test borings and refraction seismic soundings. The results of this exploration disclosed that most of the proposed building area is underlain by the municiple refuse fill. Fine grained natural soils were generally encountered beneath the refuse fill and predominantly granular soils were encountered surrounding the refuse fill. In the southeast corner of the site, predominantly granular soils were found to be underlain by fine grained soils. The distribution and pertinent characteristics of the fill materials and natural soils are described in detail below and illustrated on Plates 4, 5 and 6.

1.3.1 REFUSE FILL

The site exploration disclosed a maximum of about 47 feet of refuse fill consisting of layered brown sand with paper, rags, wood, metal, concrete and other trash. Some of the borings disclosed a maximum of four feet of sand overlying the fill materials. The Standard Penetration Resistance (SPR) within the fill materials was generally less than 10 blows per foot,

indicating a loose to very loose condition in the refuse fill. However, some of the borings showed substantially higher SPR values within the refuse fill indicating occasionally medium dense to dense conditions. Occasionally the sampling tool was brought out from the refuse fill and found to be too hot to handle with bare hands. Detailed visual examination of the samples disclosed the fill materials to consist of from 10 to 80 percent of potentially degradable material with the average content of degradable material estimated to be about 40 percent.

Estimated elevation contours of the bottom of the refuse fill based upon the boring results are shown on Plate 7. Together with the surrounding topography, these findings indicate that the refuse fill was probably dumped on top of a previous existing ground surface and covered over.

Laboratory tests on samples of the fill materials disclosed natural moisture contents ranging from 18 to 187 percent with an average value on the order of 72 percent. Representative samples of the fill material were burned in a crucible and disclosed from 3 to 50 percent organic content, based upon dry weight, with an average of 17 percent. In general, the organic content decreased with increasing depth in the fill.

1.3.2 NATURAL SOILS

Underlying the fill deposits, but generally above elevation +30, the borings encountered layered brown and gray silty fine sand, sandy silt, and silty gravelly sand. Consistent with the regional geology, these soils would be associated with the Kirkwood Formation. The SPR of samples taken in these materials range from 9 to greater than 50 blows per foot, but are gen-

erally clustered in the range of 20 to 35 blows per foot indicating these materials to be in a medium dense condition.

Underlying these silt and sand deposits, the borings generally encountered brown, brown-gray and gray clayey silt and silty clay containing occasional lenses and laminae of fine sandy silt to silty fine sand. Occasional layers of red-brown sandy clay, black and green sandy clay and brown black silt were also encountered. Based upon the SPR values, the sand and silt layers are in a medium dense to dense condition. Visual examination indicated the consistency of the silt and silty clay to range from firm to hard. These underlying natural soils would be associated with the Kirkwood Formation and the Shark River Marl.

The borings drilled on the high ground at the northern site boundary disclosed predominantly brown and gray fine to medium sand, silty sand, and silty gravelly sand with occasional clayey layers. These soils were generally encountered from the ground surface down to elevations on the order of +30. The SPR of the samples taken indicated these soils to be in a medium dense to dense condition, with the density generally increasing with depth. Two of these borings, B-39 and B-40, encountered a stratum of very stiff, dark gray, fine sandy clayey silt between elevations +35 and +65. The lower density soils encountered near the ground surface in this portion of the site are believed to be the Cohansey Sand while the deeper soils, including the fine grained stratum, are believed to be the Kirkwood Formation.

In the southeastern portion of the site the test borings disclosed layered soils appearing in a generalized profile of predominantly granular soils overlying predominantly fine grained soils. The predominantly granular

soils were observed in most of these borings to consist of yellow-brown, brown, and brown-gray sandy clayey silt, sandy silt, silty sand, and silty gravelly sand. Where encountered, this horizon was observed to range in thickness from 4 to 10.5 feet and to average about six feet. Based on the SPR of the samples taken, these soils are in a loose to medium dense condition. The fine grained soils were observed to consist of brown-gray, green-gray, gray and green fine sandy silt, clayey silt, and silty clay with occasional lenses of silty sand. The cohesive soils in this horizon were observed to be generally firm to hard in consistency, while the granular lenses appear to be in a medium dense to dense condition. These fine grained soils were encountered to the maximum depth of exploration in the area — 31.5 feet.

1.4 GROUNDWATER CONDITIONS

Groundwater measurements were made while the borings were being drilled, in open holes subsequent to the drilling of the borings and in water observation wells installed in several of the borings. Additional water level measurements were made in sealed well-points installed in eight of the test borings. Most of these observations disclosed a gravitational groundwater system indicating a gradient of groundwater flow from the north to the south across the site. Measurements in the sealed well-points disclosed perched water conditions existing in areas of the site. In addition, chemical analyses of surface and groundwater samples were made. These aspects of the groundwater conditions are discussed in greater detail herein.

1.4.1 GRAVITATIONAL WATER LEVEL

Free groundwater was encountered in most of the borings at depths generally corresponding with the bottom of the refuse fill. However, some of the borings located near the center of the building area encountered water levels within the fill deposit. Outside of the fill area to the southeast, groundwater was encountered within a few feet from the natural ground surface, while groundwater was encountered at depths from 30 to 35 feet in the borings to the north of site.

Water observation wells were installed in several of the borings to obtain long-term measurements of the groundwater level. Measurements made several months after the borings were drilled generally showed water levels at depths shallower than where water was encountered while drilling. Estimated elevation contours of groundwater level based on these measurements as shown on Plate 7 indicate a gravitational gradient of a groundwater flow from north to south across the building area.

1.4.2 PERCHED WATER LEVEL

Well-points and impervious seals were placed in eight of the borings so that measurements made in the well-point riser pipes would represent the actual groundwater (piezometric pressure) conditions in the soil strata below the impervious seals. Open riser pipes were then set in the borings above the impervious seals so that the groundwater conditions in the shallower soil strata could be observed. The observations made in these borings are summarized on Table 1, page 10. Two water levels were recorded at most of these borings. The shallow water level measurements made in the open pipes generally correspond to the elevation contours plotted on Plate 7 for the

TABLE 1 - SUMMARY OF WATER LEVEL MEASUREMENTS

Boring No.	Surface Elevation	Depth of Water(1)	September		October								
			27	30	1	2	3	4	7	8	9	10	24
B-51	27.0	1.5	- -	-(2) -	0.0 11.0	1.1 10.9	1.3 10.8	1.3 10.8	1.1 11.0	1.0 10.9	1.0 10.9	1.0 10.9	1.1 11.6
B-52	28.7	5.0	6.0 7.5	5.7 6.2	5.6 6.2	5.3 6.4	5.2 6.4	5.2 6.3	5.1 6.4	5.3 6.3	5.3 6.3	5.2 6.3	5.9 7.3
B-53	33.5	10.2			10.1	10.3	10.5	10.2	10.3	10.3	10.2	10.5	9.6 10.8
B-54	43.7	5.0				9.1 8.2	9.2 8.3	9 5 8.2	9.5 8.2	9.4 8.3	9.3 8.2	9.2 8.2	9.2 8.8
B-55	78.2	20.0									42.5	46.9	16.5 39.8
B-56	91.1	17.5								32.1 51.9	26.8 51.4	26.8 55.1	27.3 50.6
B-57	93.4	17.5 and 40 to 45					34.7 52.2		31.8 49.9	32.9 52.0	33.3 52.0	34.5 52.1	34.0 51.0
B-58	95.4	27.5									52.8	25.3	25.0 50.0

(1) Depth at which water was encountered while drilling

(2) Water level measurement in observation pipe is upper number.
Water level measurement in sealed well-point is lower number.

All water level measurements are depth below ground surface in feet.

gravitational water level. A significantly lower groundwater level was measured in the sealed well-points. The time history of these water level measurements and subsequent testing of the well-point installations confirmed that these lower water levels are representative of the groundwater conditions in the soil strata below the impervious seals.

As shown on Plates 6 and 8, the gravitational water levels generally were measured in refuse fill or granular soil horizons near the ground-surface that are underlain by predominantly fine-grain soils. The water levels measured in the sealed well-points are generally within the fine-grain soils. Thus, the gravitational water level measured in the open borings and observation wells is a perched water system that does not appear to influence the groundwater level in the fine-grained soil strata.

1.4.3 WATER QUALITY

Anticipating that the water presently leaching from the landfill might be polluting the stream traversing the south-central portion of the site from west to east, water samples were taken from the stream and chemically analyzed. Three sets of such samples were taken over a period of several months at the locations shown on Plate 2. Additional samples were taken of the groundwater in two of the borings within the refuse fill and also of the surface water at two locations near the refuse fill on the site. The water analysis reports are reproduced in Appendix B and summarized on Table 2., page 13. These water analyses demonstrate that some amount of stream pollution entering the site is an existing condition, but that the pollution level increases due to the existing site conditions. Also, the groundwater within the landfill is polluted, but the surface water shows increased levels of

pollutants that may result from stagnation and concentration of leachate flowing from the existing fill.

TABLE 2 - SUMMARY OF WATER ANALYSES

Component	Average of Samples Analyzed			
	Upstream	Downstream	Groundwater	Surface Water
pH	5.6	6.2	6.9	7.2
Total Hardness	27 ppm	60 ppm	322 ppm	261 ppm
Total Acidity	18 ppm	43 ppm	26 ppm	60 ppm
Total Alkalinity	12 ppm	55 ppm	420 ppm	980 ppm
Total Solids	172 ppm	284 ppm	687 ppm	1304 ppm
5-day B.O.D.	2.5 ppm	4.5 ppm	-	20.5 ppm
Calcium	9.3 ppm	18 ppm	113 ppm	51.6 ppm
Iron	0.44 ppm	2.5 ppm	0.15 ppm	3.85 ppm
Chlorides	40 ppm	51 ppm	31 ppm	297 ppm
Sulfates	21 ppm	65 ppm	69 ppm	31 ppm

SECTION II

DESIGN CONSIDERATIONS AND ANALYSES

The site investigation disclosed a substantial volume of refuse fill existing on the site. Handling these materials as well as the natural soils will be necessary to achieve the design grades and obtain suitable foundation support for the proposed mall buildings. The various aspects of the site and subsurface conditions are discussed and analyzed herein to determine the most suitable means for developing the site.

2.1 GENERAL CONSIDERATIONS

Proper handling of the existing refuse fill materials on the site and their influence upon the design, construction and performance of the completed mall facility represent the major considerations for the engineering design of Seaview Square. Refuse fill is a dynamic material mass in which several processes are occurring — organic materials decompose, non-decomposable materials may corrode and there is a considerable amount of material consolidation (8)*. Refuse fills are typically of low density and are loose and resilient and experience considerable settlement. Consistent with the bio-chemical processes, refuse fill materials may present a corrosive environment for conventional building materials. Thus, from preliminary technical considerations, the existing refuse fill material on the site is concluded to be totally unsuitable for the support of building elements.

The natural soils underlying the refuse fill are suitable for building foundation support. A deep foundation system would be necessary to

* See Reference Bibliography at end of this section.

transmit the building loadings through the refuse fill to the natural soils. Deep foundation systems that may be suitable include drilled-in piers, driven piles, or extruded pedestal piles.

Alternatively, the refuse fill materials could be excavated from the building area and replaced with compacted load-bearing fill. An important consideration to this approach is the availability of a sufficient volume of suitable soil for the load-bearing fill. Undercutting natural soil areas on the site will be necessary to obtain a sufficient quantity of soil for fill. This procedure will also provide areas for disposing the refuse fill that will be excavated. With the refuse fill materials disposed on site, their engineering and environmental characteristics become important considerations to the other aspects of the Seaview Square development.

2.2 BUILDING FOUNDATIONS

There appear to be two possible approaches to develop foundation support for the buildings. All of the refuse materials could be excavated from the building area and replaced with compacted load-bearing fill. In the northern portions of the buildings, natural soils ranging from medium dense silty sand to stiff clayey silt will be exposed at the proposed floor grade. Both the natural soil and the compacted fill would be suitable for foundation support. It is concluded that a foundation bearing value on the order of 4 ksf would be safely supported by these materials. Based on past experience with similar soil deposits and load-bearing fills, it is expected that any foundation settlement would primarily occur as the buildings are constructed. It is expected that post construction settlement would be negligible. Thus, spread and wall footings supported on natural soils and load-bearing fill

replacing the existing refuse fill is a feasible foundation system for Seaview Square.

The alternate approach of leaving the refuse fill materials in-place in the building area and utilizing deep foundations for building support is also technically feasible, but would involve extraordinary considerations for the building design and construction. Consistent with the expected settlement behavior of the refuse fill, structural slabs supported on the deep foundations would be required for the ground floors of the buildings. Possible obstructions in the refuse fill resulting in construction difficulties or extra foundation units might increase the cost of a deep foundation system. Special cement may be required for concrete exposed to the potentially corrosive environment and additional provisions, such as a forced ventilation system, would be necessary to provide positive protection against potential health and safety hazards.

Although premium costs would be involved, it is concluded that the removal and replacement of the refuse fill material would be the most suitable procedure for preparing the Seaview Square site for building construction. Spread and wall footings would then be utilized for support of the mall buildings. Also, the refuse materials that might present health and safety hazards would be at a distance from the buildings and some potential construction difficulties would be precluded.

2.3 REFUSE FILL MATERIALS

A refuse fill is a dynamic mass containing a significant amount of degradable materials in which several biochemical processes are active (2).

Initially, organic materials experience aerobic decomposition that is accompanied by the release of carbon dioxide gas, a musty odor, and temperatures within the fill ranging between 120° and 150° F. As the fill is sealed and the available oxygen is consumed, anerobic decomposition begins. Typically, temperatures within the fill decrease to the vicinity of 90° to 100° F, methane gas production becomes predominant and offensive odors may be detected. A black coloration is a visual indicator that anerobic decomposition processes are active or have occurred. Gas and leachate are the principle by-products of the biochemical processes and, together with the engineering properties of refuse fill materials, are discussed in detail below.

2.3.1 GAS

In addition to carbon dioxide and methane, refuse fills containing significant amounts of plaster and gypsum and fills in contact with sea water may produce sulfur dioxide. Both methane and sulfur dioxide are poisonious gasses and methane gas, in concentrations ranging between 5 and 15 percent in air, is explosive. At other refuse fill sites, methane has been detected permeating through natural granular soils surrounding these fills and into adjacent properties. In addition to the health and safety problems associated with the gas migration, methane gas is also poisonous to vegetation. Thus, gas control measures are necessary at Seaview Square.

Control of gas migration can be effected either by impermeable barriers or by a venting system (3). Materials that have been successfully used for impermeable barriers include clay blankets and plastic, rubber, or asphalt impregnated membranes. Also, a groundwater level is an effective gas barrier. The greatest effectiveness of a gas migration barrier would be achieved by placing it as close as possible to the refuse materials. Consistent with the

existing site and subsurface conditions and the building area preparation, a gas migration barrier could be placed on the excavation face of the existing refuse fill before the load-bearing fill is placed in the building area. Gas migration barriers would also be necessary where refuse disposal areas are excavated into existing natural soils adjacent to the building area.

Venting systems are frequently used to limit gas accumulation within a refuse fill and to preclude gas migration from a refuse fill. Suitable systems consist of gravel filled wells or perforated or porous drain pipe embedded in open-graded gravel at the top of the fill. This gas collection system is then vented to the atmosphere.

2.3.2 LEACHATE

Groundwater or rainwater percolating through refuse fill washes away some of the decomposition products and, as leachate flowing out from the fill, becomes a pollutant to natural water courses. The production of leachate is a function of the amount of water available to the refuse fill (5). When waste materials are initially placed in a fill, the moisture content is rather low and leachate production begins almost immediately, but in a minuscule amount. As water is added to the refuse, the moisture content of the material increases considerably to a maximum value, the field capacity of the fill, in a process very similar to a sponge soaking up water. When the field capacity is reached, additional water input to the refuse is not retained and the leachate production increases greatly, becoming almost directly proportional to the rate of water added to the fill. Since uncontrolled leachate is a pollutant both to surface water and groundwater, environmental considerations indicate that control measures should be incorporated into the site development.

Based upon the laboratory test results, it is believed that the refuse fill materials presently on the site are at their field capacity so that leachate production is expected to be in direct response to water entering the fill. Although precluding water infiltration into a refuse fill, such as from rainwater, would reduce the rate of leachate production (10), leachate may still be produced from the large amount of moisture presently existing in the fill materials. Thus, there appear to be two approaches for leachate control, collecting leachate that is flowing out from the refuse materials and preventing additional water from entering into the refuse materials. It is concluded that both of these approaches are necessary at Seaview Square.

Where the refuse materials are to be redeposited, it will be feasible to install collector drains at the site perimeter and along the stream running through the site. Additional control in disposal areas could be effected through a subdrain collector system. The collected leachate must be properly handled to assure environmental protection. An on-site treatment facility may be established, the leachate may be disposed into the municiple sanitary system, or a commercial disposal service may be engaged to dispose of the collected leachate. It is believed that the water analyses performed on the groundwater samples (See Appendix B) would be representative of the quality of the collected leachate. The results for the surface water sample analyses would represent a worst case condition of leachate quality. It was reported that this expected leachate quality is of the same order as municiple sewerage and, thus, should be acceptable to the municiple sewerage treatment plant.

Precluding rainwater infiltration into the refuse materials could be effec-

ted through several means. The finished pavement in the parking areas is expected to preclude rainwater infiltration. Before the pavement is placed and after the final site grades are achieved, intermediate rainwater infiltration could be further precluded by an asphaltic treatment to the subgrade. In the southeast portion of the site, rainwater infiltration could be precluded by utilizing fine grain soils for cover over the refuse materials and by providing positive surface drainage gradients to preclude water ponding.

2.3.3 ENGINEERING PROPERTIES

Experience with sanitary landfills (9) indicates that waste materials behave similarly to peat deposits. Upon placing load onto the materials, there is a large initial compression followed by time dependant secondary compression. Where additional fill has been placed over existing refuse fill materials, initial compressions on the order of 8 to 16 percent of the refuse fill thickness were obtained for as little as four feet of additional earth fill (12). In one instance, an additional 5 to 10 percent of secondary compression was experienced within about three years time. These data were obtained from waste deposits that had been in place for periods up to 15 to 30 years and are noted to exhibit considerable variation due to the variation in constituency of the refuse fills. Freshly placed refuse fill is reported to experience settlement on the order of 20 percent of its initial height and that about 80 to 90 percent of the settlement would be experienced within the first two to three years after the fill placement (6, 7). Thus, areas of the Seaview Square site that are underlain by refuse fill would be expected to experience a large amount of settlement that would occur, for the most part, during the construction period.

Since a substantial amount of refuse fill will be placed beneath the parking areas of the site, any procedures that would reduce the expected extreme compressibility of the refuse fill would be beneficial. Previous experiences have shown that extensive proof rolling with a heavy pneumatic tire roller produces densification to depths on the order of six feet and a much improved stable fill surface for subsequent construction operations (4). Accordingly, proof rolling of the refuse fill that is to remain in place would eliminate some of the immediate compressibility and obtain relatively stable surfaces. Where the refuse materials are to be deposited, placement in compacted layered construction would produce substantial densification and improved engineering properties. Generally, static weight rollers have provided the most effective compaction for refuse fill materials.

2.4 SITE DEVELOPMENT

The site development of Seaview Square involves both the engineering behavior aspects of the refuse fill and the natural soil materials and the environmental considerations necessary for construction utilizing these materials. The major protection and control measures necessary have been previously discussed. Incorporating these measures into the site development consistent with expected subsurface conditions is discussed below.

2.4.1 REFUSE DISPOSAL

In accordance with the most feasible approach for site development, the natural soil outside of the building area will be undercut to obtain load-bearing fill material while the refuse materials from the building area and above the proposed finished grades will be placed into these excavations.

As previously discussed, these disposal areas will be provided with leachate collector drains that would also serve to assure that the refuse materials would be below any groundwater level. The test boring results indicate that these disposal areas would extend into silty clay, clayey silt and sandy clayey silt soils. Laboratory tests, Appendix B, show that these soils are classified as silts and clays of low plasticity with not less than 15 percent finer than the No. 200 sieve. Based upon established correlations, these soils are expected to have a permeability on the order of 10^{-7} feet per minute and are thus impermeable. However, it is possible for isolated lenses of a more sandy constituency to be encountered in the refuse disposal areas. Laboratory tests indicate that these soils would have not less than five to seven percent passing the No. 200 sieve and, by correlation, are expected to have a permeability not greater than 10^{-4} feet per minute. If any such conditions are encountered, an impermeable bottom can be obtained by undercutting the sandy lens and covering with natural impervious soils or by blending bentonite clay into the sandy soils. With the refuse materials expected to be much more impervious than the natural soils, any leachate produced would readily flow to the collector drains. Additional design details of the refuse disposal areas that depend upon the location of the disposal area, are discussed below.

2.4.1 (a) SOUTHERN DISPOSAL AREAS

The subsurface conditions that would be encountered in the southeast corner of the site and to the south of the building area are illustrated on Plate 6. In general, a perched water level exists in the more granular surface soils. At the proposed bottom of the disposal area, fine grained

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impervious soils are generally encountered. Groundwater levels in these fine grain soils, as shown by the sealed well-point readings, are generally at about the proposed bottom elevation of the refuse disposal area. Based upon these conditions and the estimated soil permeability, it is believed that the maximum infiltration into a perimeter leachate collector system would be on the order of 0.001 cfm per foot of drain. This inflow would be collected by the leachate drain before contacting the refuse materials.

Rainfall infiltration into the disposal area will be most acute in the unpaved southeastern corner of the site. It is anticipated that the variations in frequency and intensity of rainfall will be sufficiently diffused as the water percolates through the refuse fill so that a nearly steady state flow will be collected by the leachate drain system. Assumming conservative values for annual rainfall and runoff coefficient, the leachate production due to rainwater infiltration is not expected to exceed about five cfm.

2.4.1 (b) NORTHERN DISPOSAL AREAS

As discussed previously, a well defined perched water condition exists in the northern portion of the site. A longitudinal profile through the northeastern disposal area is presented on Plate 8 and a typical transverse profile through this area is presented on Plate 9. The perched water table is trapped on top of finer grain soil strata that are encountered in the vicinity of the finished grade. A subsurface drain constructed at the toe of the cut slope at the perimeter of the parking area would intercept the perched water table and preclude any further influence upon the site development. Based upon the subsurface and groundwater conditions revealed by the site investigation and the estimated soil permeability, the inflow into such an interceptor drain is

not expected to be greater than about 0.001 cfm per foot of drain. Depending upon the other design details for the Seaview Square development, such an interceptor drain could be incorporated into the storm drainage system of the site.

Similar to the southern disposal areas, the leachate drain would also assure that the refuse fill materials are below the groundwater level. In the worst case, it is expected that groundwater infiltration into the refuse disposal area would not be greater than 0.0001 cfm per foot of leachate drain. Any such infiltration would be immediately collected by the drain and precluded from any contact with the refuse fill. Even though the northern refuse disposal areas will be paved, there is a possibility for some amount of rainfall infiltration. It is conservatively estimated that such rainfall infiltration would not be greater than about 0.001 cfm per foot of drain. Consistent with the expected high permeability of the refuse materials and the impermeability of the natural soils underlying the refuse, it is anticipated that any leachate would flow rapidly through the refuse to the collector drains.

2.4.2 REFUSE HANDLING

Site grading activities involving the excavation, transportation and placement of refuse fill materials are governed by the New Jersey Department of Environmental Protection Regulations. In this respect, the site development operations for Seaview Square are classified as a "distrupted landfill" rather than an active "sanitary landfill". These regulations require that areas of excavation and placement of refuse materials be limited in size and that temporary soil cover be frequently placed over the refuse materials for periods such as weekends and holidays. Intermediate and permanent soil cover

of greater thickness is required for areas of refuse fill where work will not be immediately resumed or where final lines and grades have been achieved. These procedures of limited working areas and soil cover have been demonstrated to have the additional benefit of greatly reducing odor problems during construction.

2.4.3 INSECT AND RODENT CONTROL

Another environmental aspect of refuse fill and sanitary and landfill operations is the control of insects and rodents. It is generally agreed that insect and rodent problems can be prevented by scrupulous attention to placing and maintaining a proper soil cover over the fill. However, at refuse fills that have not been maintained in accordance with present standards of sanitary landfill operation, such as the Seaview Square site, the presence of insect and rodent populations should not be precluded. Available guidelines (1) recommend that a rodent extermination program be performed before any construction activity involving refuse fill is begun. In this way, there are no rodents to seek a habitat elsewhere as the fill is disrupted for the site development.

2.4.4 EXCAVATION AND FILLING

Based upon observations of compactor trucks driving across the existing fill, it is believed that most types of excavating equipment would be capable of operating on the site. However, consistent with the groundwater level and moisture content of the refuse fill, pockets of extremely loose/soft material might be encountered and periods of inclement weather may render portions of the site untrafficable to rubber tired equipment.

The traditional methods of earth fill construction and quality control are not expected to be applicable to the refuse materials. In general,

the refuse should be placed in a layered construction with each layer thoroughly compacted with a heavy roller. It is concluded that control of this compaction procedure would then be most appropriately based upon the behavior of the material under the successive passes of the compactor. Past experience has shown that refuse materials are usually readily compactible in spite of the high water contents (11). It is believed that a test fill constructed in advance of the general construction would be instructive in determining the optimum number of compactor passes to achieve satisfactory stabilization and densification of the refuse fill materials.

Another aspect of site grading that would be affected by the refuse fill is the placement of soil fill either as temporary or intermediate soil cover or to increase the overall proportion of soil to refuse to provide a more stable fill. The refuse fill underlying any soil fill is expected to be resilient under the weight of construction equipment. Under such conditions, experience has shown that it is difficult to obtain satisfactory soil compaction. It is believed that this potential problem can be best overcome by utilizing readily compactible predominantly granular soils selectively excavated from the site for such fill.

2.5 SUBSURFACE DRAINAGE

The estimated elevation contours of free groundwater surface on Plate 7 show existing water levels at elevations above the proposed floor grade in the building area. Although this existing groundwater level is expected to be lower after the site development, the possibility of a long-term groundwater level above elevation +44 along the northern perimeter of

the building area should not be precluded. Thus, the design of the building should incorporate a perimeter subsurface drain consisting of a perforated or porous pipe embedded in filter gravel along basement retaining walls. Also, a portion of the lower level floor slab should be provided with subsurface drainage to prevent hydrostatic pressures beneath the floor. A final determination of the necessity for such a subfloor drain would be made during construction. Consistent with the expected placement of the refuse fill materials to the north of the building complex, water collected in such a subsurface drainage system should be treated as leachate and disposed of through the leachate handling systems.

2.6 SITE UTILITIES

It is possible for the expected settlement of refuse materials to distort drainage gradients of sewer lines and possibly cause openings at the joints of pipes and conduits. Also, utilities installed within the refuse fill materials could become an inadvertent vent system for decomposition gasses. To preclude such detrimental effects, it is concluded that underground site utilities should be either minimized or designed to accommodate the influence of the site conditions. It is believed that the only feasible means of minimizing the amount of subsurface utilities is to dispose of as much of the storm water as possible through surface flow over the parking area pavement rather through a storm drainage system.

There appear to be several possible approaches to designing utility systems to accommodate the anticipated settlement. The most conservative approach would be to excavate the refuse fill and replace with compacted soil

fill or leave existing natural soils in place along the utility lines. The cost of this procedure could be reduced somewhat by grouping the utilities — water, sanitary sewer, telephone and electricity — as much as possible into corridors. Alternatively, these utilities could be supported on deep foundation units, such as driven piles or extruded pedestal piles, but settlement of refuse fill surrounding and underlying these installations would impose down-drag forces on the utility lines and their foundation supports. Considering the possible consequences of utility damage and service disruption, it is concluded that rigid support should be provided and that a corridor of soil fill or natural soil is the best choice.

The storm drainage systems, may not, in general, be as critical in terms of the potential consequences of service disruption as the other utilities. However, leakage of water into the refuse fill could cause accelerated decomposition, differential settlement and leachate production. Therefore, it would be good practice to locate the storm drainage system as much as possible outside of the refuse fill areas. Where it is not feasible to accomplish this, it would be beneficial to use steeper than normal gradients and to specify a pipe design that permits some amount of elongation, contraction or angular distortion at the joints.

2.7 PAVEMENT

Consistent with the engineering properties of the refuse fill materials, it is expected that the parking areas of the site underlain by refuse fill would experience a moderate to significant amount of settlement that would occur largely within a year or two from the placement of the

refuse fill. It is possible for this settlement to be irregular in its occurrence consistent with the irregular composition of the refuse fill. In this situation, the most reasonable approach is to construct an impervious surface seal as soon as the design subgrade elevations are obtained to preclude rainwater infiltration into the refuse materials. Delaying the paving of the parking area until the opening of the mall would preclude much of the adverse settlement from affecting the pavement. Nevertheless, some post-construction settlement is to be expected. In this case, a flexible pavement design selected with the expectation that maintenance work might be necessary because of continued settlement would be most appropriate.

Designing the pavement so that traffic loadings and weather conditions would not have an adverse effect of the pavement performance rather than to overdesign a pavement section for the expected settlement is the most feasible approach. Consistent with the potentially soft and resilient subgrade afforded by the refuse fill, it is concluded that a thick subbase of readily compactible granular soil would provide most of the design pavement strength. Such a thick subbase course would then provide the permanent soil cover over the refuse fill and aid in the control of gas migration.

2.8 ENVIRONMENTAL PROTECTION

In addition to the construction procedures necessary for the refuse fill, additional design and construction details are necessary to assure that erosion and sediment transport from the site during and after construction will not produce adverse effects off the site. It is understood that silt entrapments are to be constructed in conjunction with the flood

control measures along the existing stream. Proper coordination of the various stages of site development work with the silt entrapment construction would facilitate erosion control procedures. Advance planning of the construction sequence would also facilitate rapid construction progress unhampered by adverse construction conditions.

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SECTION III

CONCLUSIONS AND RECOMMENDATIONS

It is concluded that it is technically feasible to develop this site for the construction of the proposed Seaview Square Mall. The most suitable development scheme for this site is to excavate the refuse fill from the proposed building area and replace the excavated material with compacted load-bearing fill for support of conventional spread and wall footings. Detailed recommendations for site preparation, load-bearing fill construction, building foundation design and construction, site grading and other aspects of the shopping mall development that are influenced by the geotechnical conditions of the site are presented below.

3.1 BUILDING SITE PREPARATION

The general approach of removing the existing refuse fill from the building area and utility corridors and replacing with load-bearing fill requires special building site preparation. Included within the site preparation are guidelines for excavating the waste fill and recommendations for gas and leachate control.

3.1.1 EXCAVATION

The site excavations to remove unsuitable materials in the building areas should be of sufficient extent so that the zone of significant foundation bearing stresses is contained within competent materials. Also, excavations for refuse disposal adjacent to the building area should leave sufficient natural soil to provide foundation support. The excavation limit at the natural soil interface should be determined by a line projected downward to a

1 to 1 slope from a point at the foundation bearing elevation and five feet outside of the foundation units. In the case of utility corridors, the line should be projected downward from the outer limits of the utility lines. These criteria are illustrated on Plate 10.

A secondary criterion for the limit of excavation relates to the construction slopes in the existing refuse fill and the requirement to place soil cover over the exposed refuse. Where the excavation limit is attained, an intermediate soil cover at least one foot thick should be placed as shown on Plate 10. It is believed that bulldozing natural soils up the slope from the bottom of the excavation would be the most feasible means of placing the intermediate cover. The excavation slopes should be constructed an an inclination that would facilitate placement of the intermediate cover and assure the continued integrity of the intermediate cover. Therefore, it is recommended that excavation slopes should not be steeper than 1 horizontal to 1 vertical.

3.1.2 GAS AND LEACHATE CONTROL

To prevent gas migration from the refuse fill into the mall building areas, it is recommended that an impermeable barrier be placed between the refuse fill and the compacted load-bearing fill. A 10-mil plastic membrane with field cemented lap joints five feet wide is concluded to be the most suitable gas barrier. Alternately, a layer of natural clay soil three feet thick could be used for the gas barrier. To be most effective, the gas barrier should be placed as close to the refuse as possible and keyed into the natural soils as shown on Plate 10. To assure complete protection to the mall, the gas barrier should be supplemented by a perimeter vent system as discussed in a subsequent section (3.7.6)

site exploration disclosed that most of the natural soil materials on the Seaview Square site and adjacent ground would be suitable for load-bearing fill. Where natural subgrade soils that are susceptible to softening under equipment traffic are encountered, it is recommended to construct load-bearing fill from predominantly granular soils obtained from selective site excavation.

3.2.3 FILL PLACEMENT

Load bearing fill should be placed in accordance with the "Guide Specifications for Load-Bearing Fill", Appendix D. The fill materials should be spread in approximately horizontal layers not exceeding a loose thickness of eight inches and thoroughly compacted. Fill placed below the foundation bearing elevation should be compacted to an average of 95 percent of the Maximum Modified Density determined from ASTM D 1557-70. The minimum acceptable degree of compaction for any test would be 92 percent, provided the average criterion of 95 percent is met. Fill placed above the foundation bearing elevation for the support of floor slabs should be compacted to a minimum of 90 percent of the Maximum Modified Dry Density. It is believed that a vibratory roller having a minimum static weight of 140 pounds per inch of drum width would provide the most effective compaction of predominantly granular soils. However, if substantial amounts of fine grained soils are encountered, a static weight roller is believed to be the most suitable. Extreme care should be exercised during the placement and compaction of load-bearing fill to avoid damaging the gas barrier.

3.3 SPREAD AND WALL FOOTINGS

It is recommended that the mall buildings be supported on spread and wall footings bearing on compacted load-bearing fill or on natural soils. These footings should be designed and constructed in accordance with the criteria summarized below.

3.3.1 BEARING VALUE

Spread and wall footings bearing on compacted load-bearing fill and natural soils should be proportioned for combined dead and live loads at a maximum bearing value of 4 ksf. To preclude shearing displacement, wall footings should be constructed to a minimum width of two feet regardless of the bearing pressure.

3.3.2 FOOTING DEPTH

To provide sufficient confinement to the foundation soils, footings should be constructed at least two feet below adjacent finished grades. Exterior footings and footings exposed to freezing conditions should be constructed at least 2.5 feet below the lowest adjacent finished grade.

3.3.3 FOOTING CONSTRUCTION

Footing excavations should be protected at all times from freezing conditions and ponded water. Immediately prior to concreting, the bearing materials should be inspected and any loosened or disturbed soil should be removed and replaced with lean concrete. Alternately, the excavated materials may be replaced with compacted gravel or load-bearing fill. Footings that are not poured against the excavations should be backfilled as soon as possible after the forms are removed.

3.4 BASEMENT AND RETAINING WALLS

Basement walls and retaining walls that are restrained against lateral deformation should be designed for the earth pressure at-rest condition. It is recommended that these walls be proportioned to resist lateral stresses equivalent to the hydrostatic pressure imposed by a fluid weighing 60 pcf. In addition, walls should be designed to resist a uniform lateral pressure equivalent to one-half of the expected live load surcharge pressure on the backfill surface. Retaining walls that are unrestrained against lateral movement and located where movement of the backfill surface would not be detrimental may be designed for the active earth pressure condition. These walls should be designed for an equivalent fluid weight of 40 pcf and a surcharge coefficient of one third.

Because of the potential proximity to refuse materials, basement retaining walls in all of the buildings should be designed and constructed as a secondary gas barrier. All cold joints between wall pours, walls and footings, and walls and floor slabs should be provided with an elastic waterstop. Before backfilling, walls should be spread with an asphaltic or hydrolithic coating, especially at any utility penetrations through the walls.

Special consideration should be given to the selection and design of retaining walls to effect grade changes in areas underlain by refuse. It is believed that the settlement that is expected from the refuse fill would be detrimental to the structural integrity of most types of rigid retaining walls. It is recommended that consideration be given to the use of bin, crib, or gabion type retaining wall systems in the parking areas. Preferably, grade changes should be effected through the use of slopes.

3.5 SUBSURFACE DRAINAGE

It is recommended that subsurface drainage systems be installed in the northern portion of the mall buildings. A perimeter subdrain should be installed behind the basement retaining walls throughout the area shown on Plate 11. Perimeter drains should consist of a six-inch diameter perforated PVC or bituminous fiber pipe bedded in at least three inches of graded filter gravel. The filter gravel should be graded in accordance with the requirements of the New Jersey State Highway Department for No. 1A or 5A Soil Aggregate modified so that not more than five percent is finer than the No. 200 sieve.

Subfloor drain laterals spaced not more than 50 feet on center should be installed in the areas of the building shown on Plate 11. These drains should consist of at least four-inch diameter perforated PVC or bituminous fiber pipe bedded in filter gravel and located at least one foot below the floor subgrade elevation as shown on Plate 11.

Consistent with the proximity of refuse fill materials, it is possible for leachate to be collected in the subsurface drainage systems. Thus, these systems should be designed so that collected water is discharged through the permanent leachate control system for the Seaview Square development.

3.6 FLOOR SLABS ON-GRADE

Floor slabs should be supported on-grade consistent with the observed groundwater conditions and the expectation that the load-bearing fill materials will contain a sufficient amount of fine soil particles to

support a capillary rise of water, it is recommended that damp-proofing be provided beneath floor slabs on-grade. This damp-proofing should consist of a four-inch thick granular base course and an impervious membrane that serves an additional function as a supplemental gas barrier. The granular base course serving as a capillary break should consist of sound durable gravel or crushed stone fairly well graded between 3/4 inch and the No. 4 sieve size with not more than 10 percent by weight finer than the No. 4 sieve. A ten-mil polyethylene, or similarly rated vapor barrier, should be placed on the granular base course prior to pouring the floor slab. To provide additional protection during construction, the barrier should be sandwiched between thin layers of sand.

Because of the function as a supplemental gas barrier, the vapor barrier should be lapped and cemented at joints to assure its integrity. Penetrations through this barrier should be minimized by placing subfloor utilities above the barrier where practical. Subfloor structures, such as equipment and utility pits, should be poured monolithically as much as possible. Cold joints between base slabs and walls and walls and floor slabs should be provided with elastic waterstops.

3.7 SITE DEVELOPMENT CONSTRUCTION

Excavation and filling outside of the building area will involve both natural soils and the refuse fill materials presently on the site. Recommendations for the site development construction outside of the building areas are summarized below.

3.7.1 SITE PREPARATION

Trees and brush should be removed from areas of the site not in the refuse fill that are to be excavated or filled. Topsoil in the natural soil areas should be stripped from excavation areas and from fill areas that are to receive less than three feet of fill. The topsoil should be stockpiled for reuse later in the landscaped areas of the mall development. Very soft soils should be undercut or covered with lifts of coarse gravel, as necessary, when encountered in fill areas to facilitate the subsequent fill placement.

Refuse materials in areas to receive additional fill should then be compacted on-grade in accordance with the "Guide Specifications for On-Grade Compaction", Appendix C. It is anticipated that a heavy pneumatic tired roller would be the most appropriate equipment for this on-grade compaction. The proof-rolling should continue until a reasonable degree of stability is achieved in the subgrade materials. Based upon reported experience, it is expected that six to ten passes of the roller would be necessary to achieve a desirable degree of stability with the existing refuse materials. To determine the amount of proof-rolling necessary, it is recommended that a test fill program be conducted on the site.

3.7.2 FILL PLACEMENT

Materials placed for fill outside of the building area are anticipated to consist primarily of the refuse materials excavated from the building area and from the parking area around the buildings. These refuse materials should be placed and compacted in lifts not thicker than two feet in accordance with the "Technical Specifications for Refuse Fill Construction",

Appendix E. It is believed that a heavy static weight roller of either the pneumatic tire or tamping foot type would be the most effective for the refuse materials. Sufficient passes of the roller should be made until no appreciable additional compaction is obtained. Based upon past experience, it is believed that between four and eight complete roller passes would produce the desired compaction. Since the customary procedures of fill quality control based upon in-place densities would not be appropriate for the refuse materials, a test fill would be desirable to establish the compaction procedure.

Although inspection of the samples taken from the borings generally showed a fairly significant percentage of soil within the refuse materials, this condition may not always exist. It is possible for there to be pockets or lenses of refuse material that are unworkable for quality fill placement. Should such pockets be encountered, it is recommended that the material be mixed with soil or inter-layered in relatively thin layers with soil as it is placed in the site fill. The decision when to apply this procedure should be made in the field by a competent Resident Engineer.

3.7.3 CONSTRUCTION CONDITIONS

The environmental regulations of New Jersey will have a controlling influence upon the site grading operations. In general, each active excavation and fill area should be limited to an area of exposed refuse on the order of 15,000 square feet. The exposed refuse in active excavation and fill areas where construction will not resume on the following day, such as weekends or holiday periods, should be covered with at least six inches of temporary soil cover. Excavation and fill areas that are brought to design

line and grade should be provided with an intermediate cover of at least one foot of soil. Permanent soil cover in areas that are not to be paved should consist of at least two feet of soil.

During the site grading operations, the contractor should provide whatever facilities are necessary to control blowing paper and other debris. Also, the contractor should maintain a fire prevention program and have suitable fire extinguishing capabilities available in the event the refuse materials ignite.

3.7.4 SITE DRAINAGE

To facilitate the construction of the northern refuse disposal area, it is recommended that subsurface drainage be installed to intercept the perched water condition. This interceptor drain should consist of perforated metal, bituminous fiber or plastic or porous concrete pipe bedded in at least three inches of filter gravel as shown on Plate 12. The filter gravel should consist of New Jersey State Highway Department No. 1A or 5A Soil Aggregate modified so that not more than five percent is finer than the No. 200 sieve. To assure proper functioning of the drainage system, the pipe should be placed on a minimum gradient of 0.0015. Alternatively, it may be possible to incorporate the interceptor drain into the storm drainage system. As shown on Plate 12, one possibility is to bed the storm drain in filter gravel and install short lengths of drain pipe at each manhole or catch basin so that the collected subsurface water would flow into the storm drainage system. If the spacing between manholes or catch basins is greater than about 200 feet, it is recommended that a drain pipe be installed along with the storm drain as shown on Plate 12. In all cases, the interceptor drains should be constructed in natural soils.

To facilitate site drainage and improve construction conditions in the western portion of the site, it is recommended that drainage swales be constructed into the swampy areas adjacent to Route 18 at an initial stage of site construction. While construction is in progress elsewhere on the site, this area will thus drain and observations can be made to determine the necessity for installing additional subsurface drains.

3.7.5 LEACHATE CONTROL

It is recommended that leachate collection systems be installed in all new areas of refuse fill disposal on the site. These collection systems would prevent leachate from percolating into the groundwater and surface water regimes and will assure that the deposited refuse materials are above groundwater. The leachate collector should consist of six-inch perforated bituminous fiber or plastic pipe embedded in at least three inches of graded filter gravel as shown on Plate 13. These drains should be installed at a minimum gradient of 0.0015 around the outside perimeters of the disposal areas in the southeastern portion of the site.

It is expected that the soils encountered in the excavations for refuse disposal will be impervious. However, isolated lenses of more pervious soils characterized by less than 15 percent finer than a No. 200 sieve might be encountered. To assure groundwater protection, it is recommended that any such pervious soils be undercut and covered with at least two feet of naturally occuring impervious soils as shown on Plate 13. Alternatively, the pervious natural soils can be treated by blending processed bentonite clay, such as Volclay, into the natural pervious soils. It is recommended that an application rate of three to five pounds per square foot be used.

The collected leachate should be disposed in a manner to prevent surface water pollution. One means of accomplishing this is to conduct the leachate collectors to holding tanks and contract with a scavenger service to remove the collected leachate. Alternatively, the leachate may be discharged into the local sanitary sewerage system either directly or with some preliminary treatment. The water quality tests made during this study indicate that the leachate quality will most probably be on the same order as the municiple sewerage.

3.7.6 GAS VENTING

To preclude the accumulation of decomposition gasses within the refuse fill and the migration of these gasses to areas outside of the refuse fill, it is recommended that gas venting systems be installed. These gas vents should consist of perforated pipe placed on top of the refuse fill and surrounded by porous granular backfill as shown on Plate 14. Such gas vents should be placed around the building perimeter, along utility corridors, and along the northern site boundaries where the adjacent ground is at higher elevations than the finished site grades. Riser pipes to vent any collected gasses should be located at the outside corners of the buildings and at intervals not greater than 300 feet along the northern property limit.

Vent stacks bedded in open graded gravel should also be installed at utility crossings from refuse fill into protected building areas as shown on Plate 14. Additional venting in the refuse disposal areas can be incorporated into the light standards as shown on Plate 14. It is not anticipated that any odor problems will result from the gas vents. However, should there be such a problem, burners could be installed on the gas vents to eliminate any odors.

3.8 PAVEMENT CONSTRUCTION

It is recommended that a subbase of at least three feet of compacted soil be placed over the refuse fill materials in the areas of the site that are to be paved. This thickness of soil will also exceed the state requirement for permanent cover of landfills. Before placing this subbase, the surface of the refuse fill should be thoroughly proof-rolled with a heavy pneumatic tire roller in accordance with the "Guide Specifications For On-Grade Compaction", Appendix C. Inorganic soil fill materials free from trash or other degradable inclusions should be placed in approximately horizontal lifts not greater than eight inches in loose thickness. Each lift should be compacted to at least 90 percent of the Maximum Modified Density determined by ASTM D 1557-70 except that the upper six inches of subbase should be compacted to at least 95 percent of relative compaction. Anticipating that the subgrade of refuse fill will be somewhat resilient, predominantly granular soil is preferred for subbase construction.

Most of the settlement resulting from decomposition and consolidation of the refuse fill materials is expected to occur shortly after the site grading is completed. Therefore, it is recommended that paving of the parking areas be postponed until shortly before the opening of the mall. To preclude leachate production and to protect the completed pavement subbase, it is recommended that an asphalt surface treatment be applied after the site grading is completed. A partial pavement construction may be made in areas of the site subjected to construction traffic. Such a partial construction should consist of a minimal pavement section or the base course of the completed pavement section. Anticipating that some amount of settlement

will occur after the mall is completed and opened, it is recommended that a flexible and easily repaired pavement section be constructed. Such a flexible pavement construction over a high quality subbase could be easily upgraded or rehabilitated by placing an overlay pavement.

It is recommended that different pavement sections be used for the general parking areas and heavy traffic areas, such as roadways, major traffic aisles, and loading docks, of the site. Alternate pavement sections for these areas utilizing gravel base course and bituminous stabilized base course are presented in Table 3.

TABLE 3 - PAVEMENT

Course	General Parking Areas		Heavy Traffic Areas	
Bituminous Concrete Surface Course	2 in.	1 in.	3 in.	1.5 in.
Gravel Base Course	6 in.	—	8 in.	—
Bituminous Stabilized Base Course	—	3 in.	—	5 in.

3.9 ENVIRONMENTAL PROTECTION

Implicit in the recommendations previously presented for the design and construction of the site development are environmental protection measures. Additional environmental considerations involve insect and rodent control, erosion, sedimentation and rainwater runoff control both during and after construction, and gas monitoring. Recommendations for these aspects of environmental protection at the Seaview Square development are summarized herein.

3.9.1 INSECT AND RODENT CONTROL

It is recommended that a rodent extermination program be instituted before any significant construction activity is started on the Seaview Square site. This extermination should be maintained during the site development construction, especially in untouched areas of refuse fill, until all refuse is covered and sealed. A commercial exterminator would be best equipped and skilled to perform this program. Covering and sealing the refuse as recommended will preclude any future rodent habitation in the refuse.

The necessity for insect control will be largely a function of the time of year of the construction. It is recommended that if insects become a problem during construction, periodic applications of insecticide may be necessary. Again, after the refuse is covered and sealed, an insect problem will be largely precluded.

3.9.2 EROSION AND SEDIMENTATION CONTROL

Another important aspect of environmental protection is the inclusion of measures to preclude or minimize erosion of unprotected surfaces during construction and to prevent sediments from being transported off of the site and into the natural water courses. Such measures during the period of construction include careful attention to construction grades to limit runoff velocities and preclude erosion and to channelize runoff water so that more careful control can be exercised. The rainfall runoff should be directed into a sedimentation basin so that the water leaving the site is not excessively turbid. When properly designed, the sedimentation basins also serve the function of retention basins so that rainfall runoff discharged from the site will not create a flooding potential downstream.

Past experience has shown that erosion and sedimentation control is most effectively managed by working in close cooperation with the site development contractor. The various aspects of excavation and filling should be closely coordinated and integrated into an overall scheme of erosion and sedimentation control. In addition to sedimentation basins and retention basins, control measures also instituted during construction include sediment traps constructed of brush or hay bales, energy dissipators to limit water velocity in runoff channels, and staged construction of permanent storm drainage facilities. A properly prepared erosion and sedimentation control plan will incorporate and integrate the permanent detention basins and storm drainage systems into the construction sequence as much as possible so that maximum utilization is made of the permanent facilities. Although it is understood that formal submission and review of an erosion and sedimentation control program is not always required for land development in New Jersey, it is recommended that such a plan be developed and followed so that any adverse effects of the Seaview Square construction will be minimized.

3.9.3 GAS MONITORING

The recommended procedures for building site preparation and building construction provide several barriers against gas migration into the building spaces. In the unlikely event that gas does migrate into the building space, it is expected that the ventilation system within the mall will preclude any accumulation of gas. However, gas may accumulate in unventilated spaces such as escalator and utility pits and equipment rooms. It is recommended that these enclosed spaces be periodically monitored to detect any possible gas accumulation.

3.10 CONSTRUCTION SEQUENCE

Consistent with the environmental aspects of the Seaview Square development and the unusual nature of the site materials to be handled, it is recommended that an overall construction sequence be developed and specified. With a properly managed and coordinated construction operation, the amount of soil necessary for temporary refuse cover will be kept to a minimum and finished lines and grades in limited areas will be achieved as quickly as possible to facilitate the placement of intermediate and permanent soil cover. Although this construction sequence would cover primarily the site development and refuse handling, the erosion and sedimentation control requirements should also be included.

The first major stage of construction should be to develop the retention basins along the existing stream through the site to facilitate subsequent erosion and sedimentation control throughout the period of site development construction. In conjunction with this stage, the culvert for the minor stream in the southeast corner and drainage swales in the western portion of the site should be constructed.

The next major stage of construction would be initiated by construction of the leachate handling facility. Following this, soil borrow and refuse disposal areas should be developed. Starting this construction to the south of the building area is believed to be the most practical approach. Refuse excavation from the building area could then proceed with the development of the disposal area proceeding to the east and north around the building area. As needed, the refuse disposal area in the southeast corner of the site could also be developed. As the refuse disposal areas are developed,

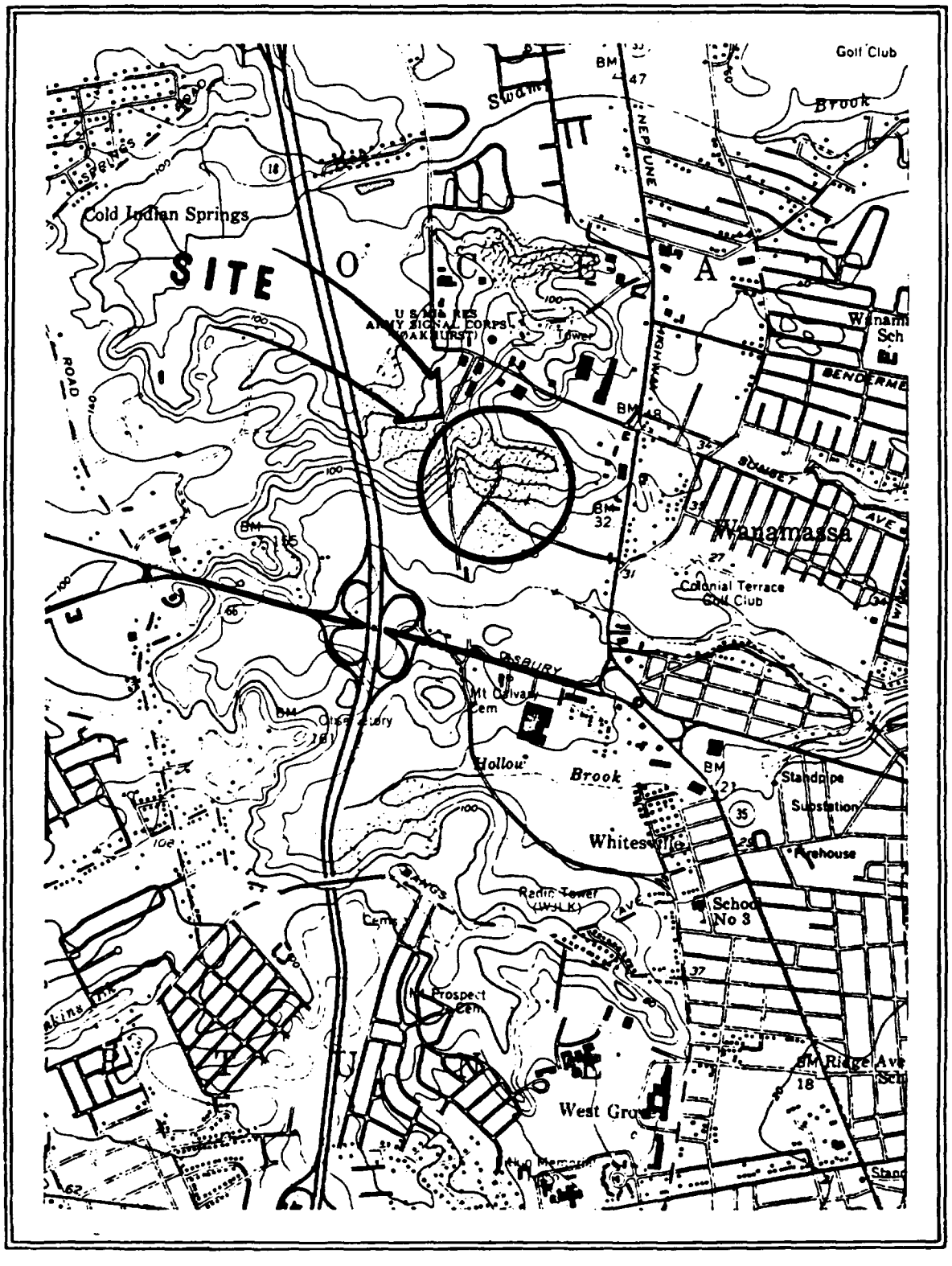
the leachate collection drains should be installed. Before excavating the natural soil in the refuse disposal areas at the northern portion of the site, the perched water table interceptor drains should be installed. Placing permanent soil cover and pavement subbase should be performed concurrent with refuse placement at a final stage of site development.

Before construction begins, it is recommended that a much more detailed construction sequence be developed in conjunction with the Contractor. In this way, there would be adequate opportunity for the Contractor to exercise his initiative and also develop an appreciation of the environmental protection aspects of the site development.

3.11 LIMITATIONS

All conclusions and recommendations presented in this report are based on the assumption that the subsurface conditions do not deviate appreciably from those disclosed by the site and subsurface exploration and are subject to confirmation and revision pending review of the final plans and specifications and construction conditions. The conclusions and recommendations presented in this report are believed to be properly conservative criteria for the planning and design of the Seaview Square Mall. Consistent with the properties and behavior of the refuse fill materials, these conclusions and recommendations are also based on the premise of competent field engineering and inspection during construction.

PLATES



Scale Feet

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000510

REGIONAL LOCATION PLAN

PLATE 1

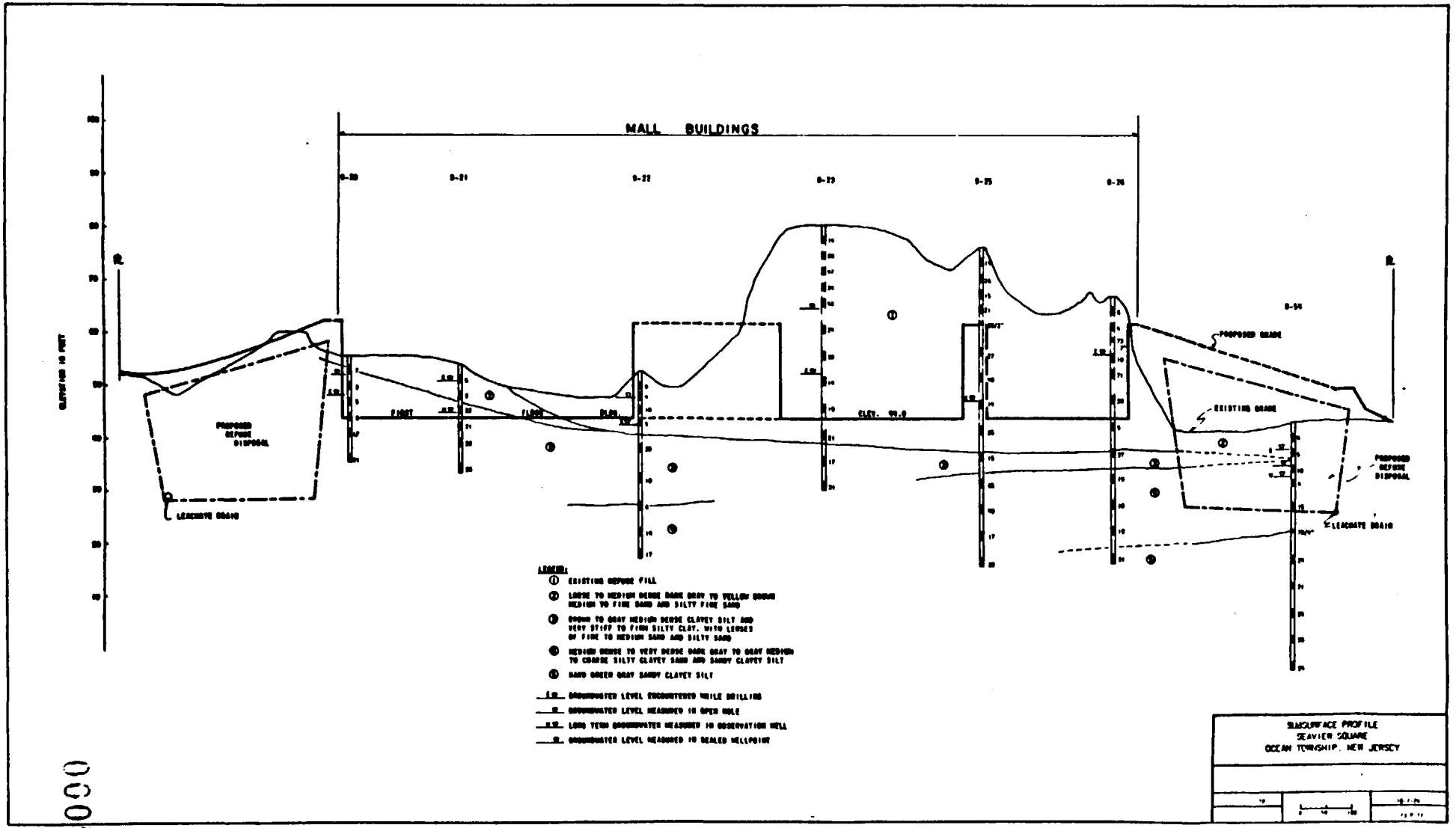


PLATE 4

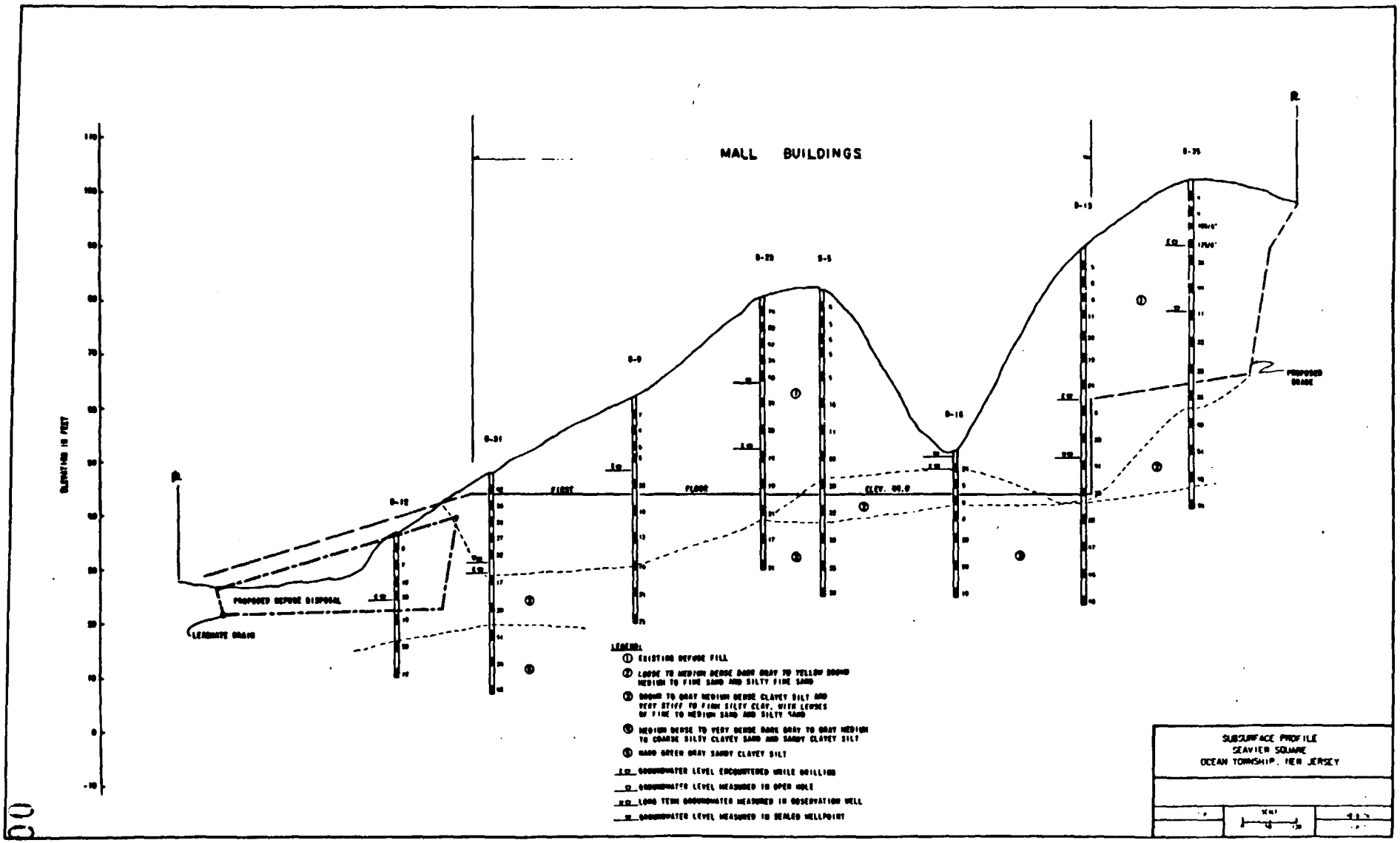
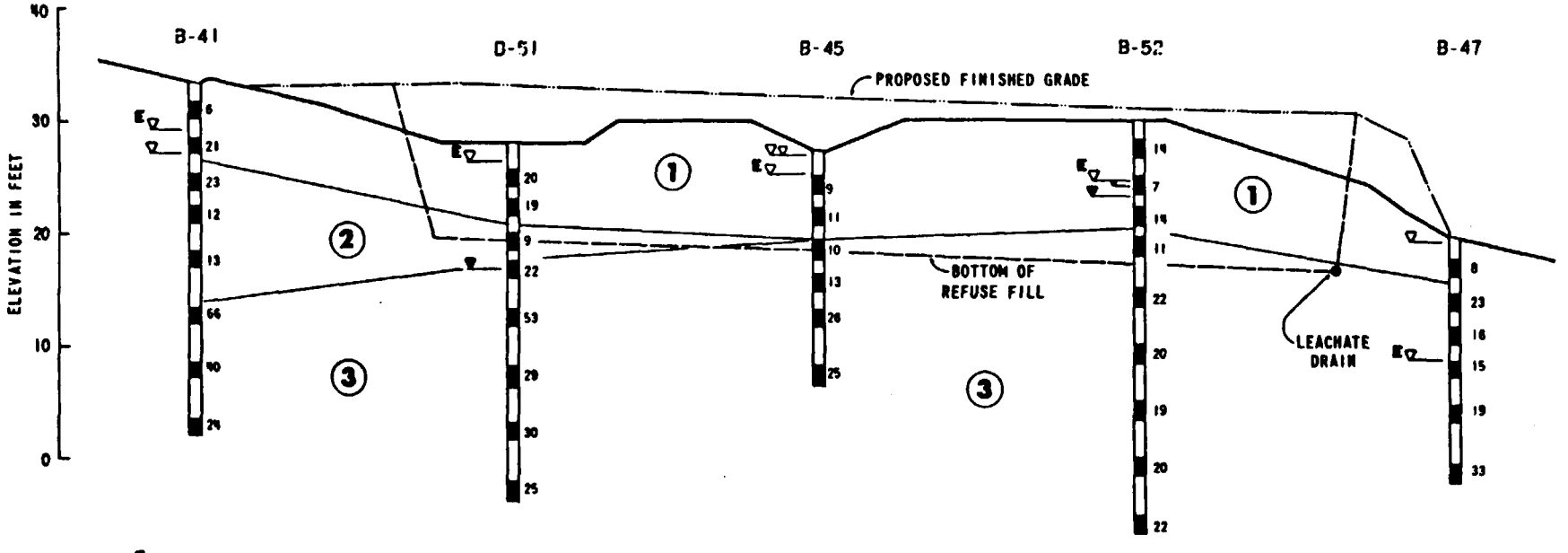


PLATE 5

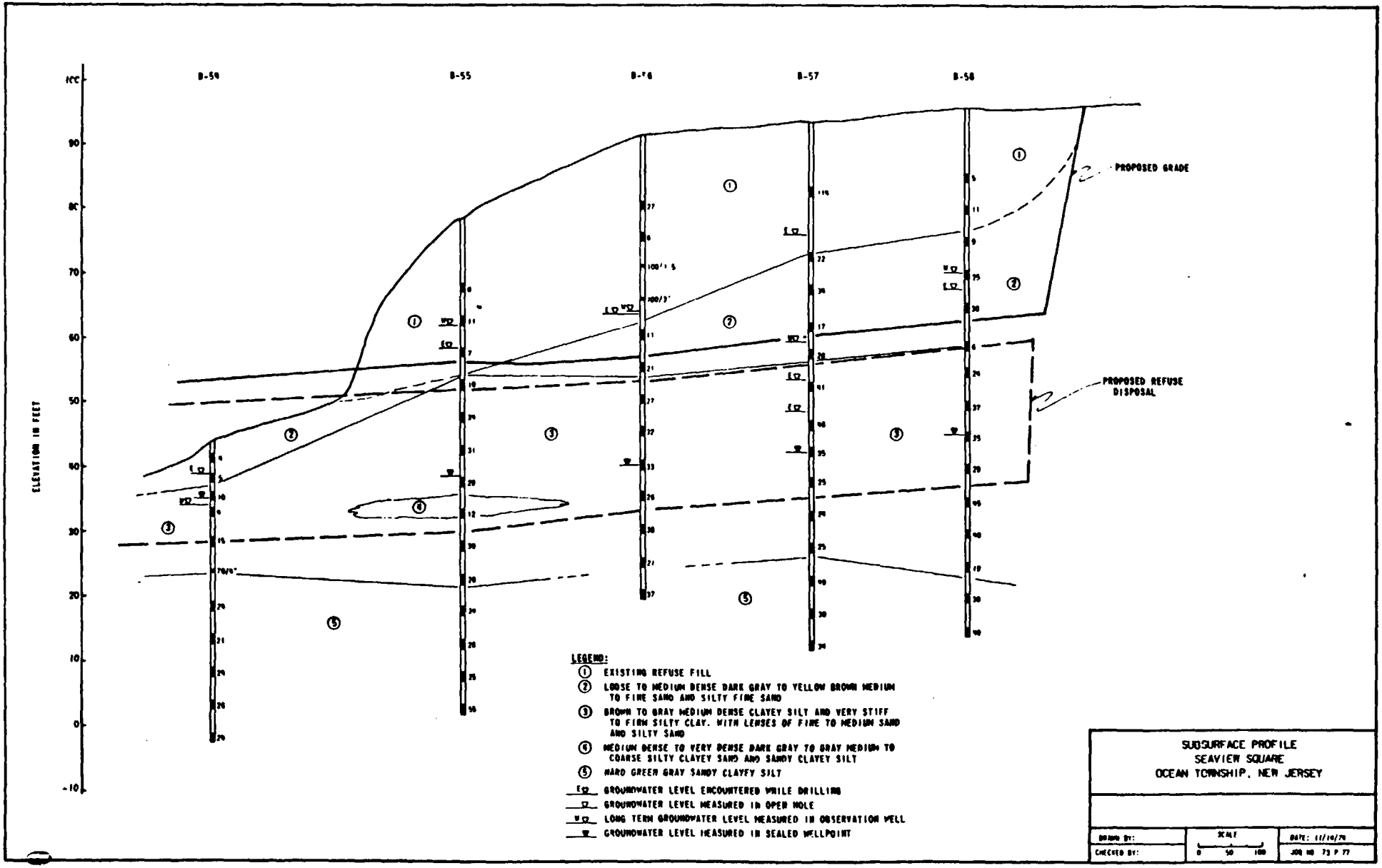


SUBSURFACE PROFILE
SEAVIEW SQUARE
OCEAN TOWNSHIP, NEW JERSEY

WOODWARD • GARDNER AND ASSOCIATES, INC.
CONSULTING ENGINEERS AND GEOLOGISTS

DRAWN BY: B CORSON	SCALE IN FEET 0 100	DATE: 10/7/74
CHECKED :		JOB : 73P77

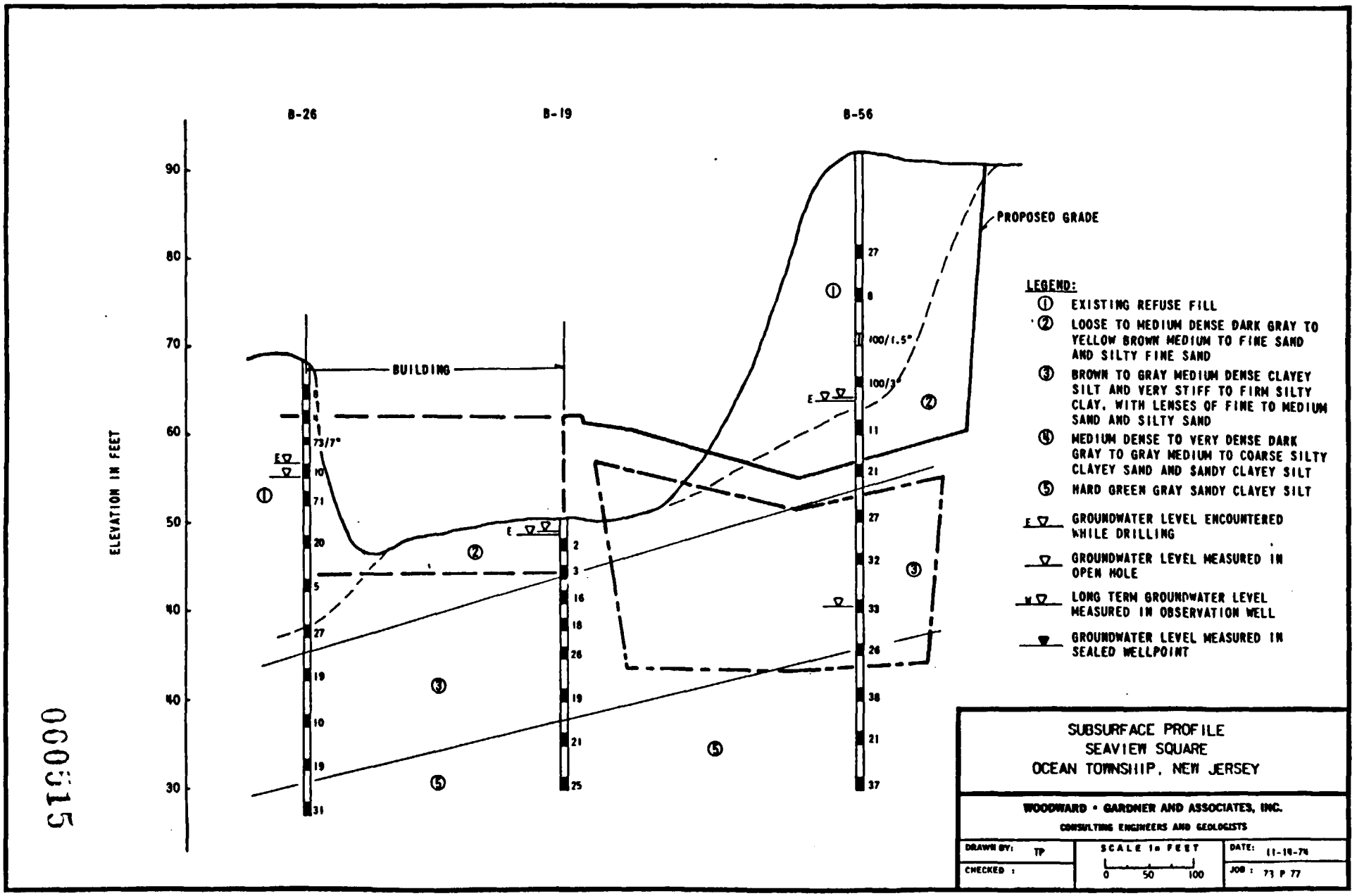
PLATE 6



SUBSURFACE PROFILE
SEAVIEW SQUARE
OCEAN TOWNSHIP, NEW JERSEY

DRAWN BY:	SCALE 0 50 100	DATE: 11/10/76
CHECKED BY:		JOB NO 73 P 77

PLATE 8



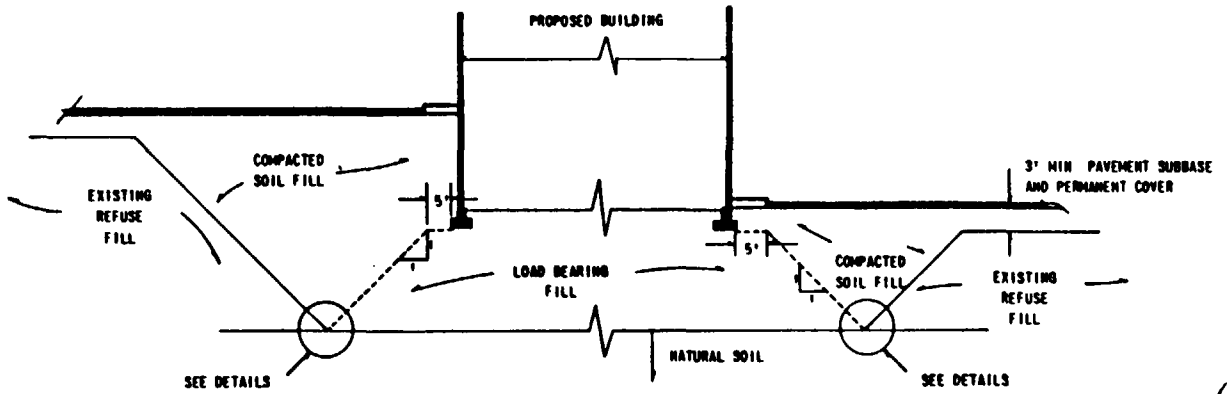
SUBSURFACE PROFILE
SEAVIEW SQUARE
OCEAN TOWNSHIP, NEW JERSEY

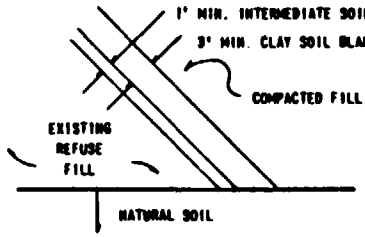
WOODWARD • GARDNER AND ASSOCIATES, INC.
CONSULTING ENGINEERS AND GEOLOGISTS

DRAWN BY: TP	SCALE 1" = FEET (0, 50, 100)	DATE: 11-19-76
CHECKED :		JOB : 73 P 77

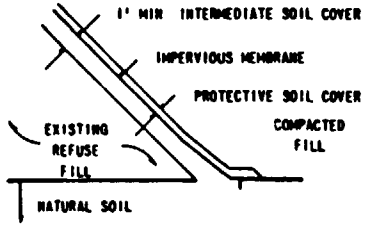
PLATE 9

REFUSE EXCAVATION AREAS

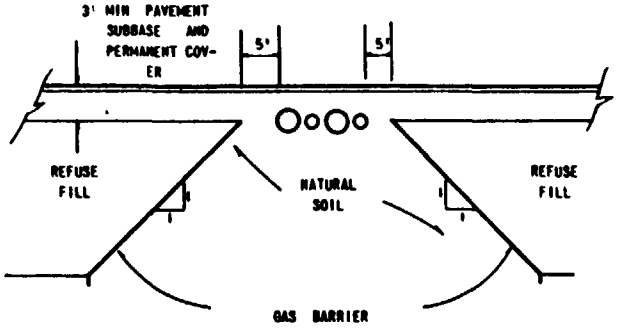




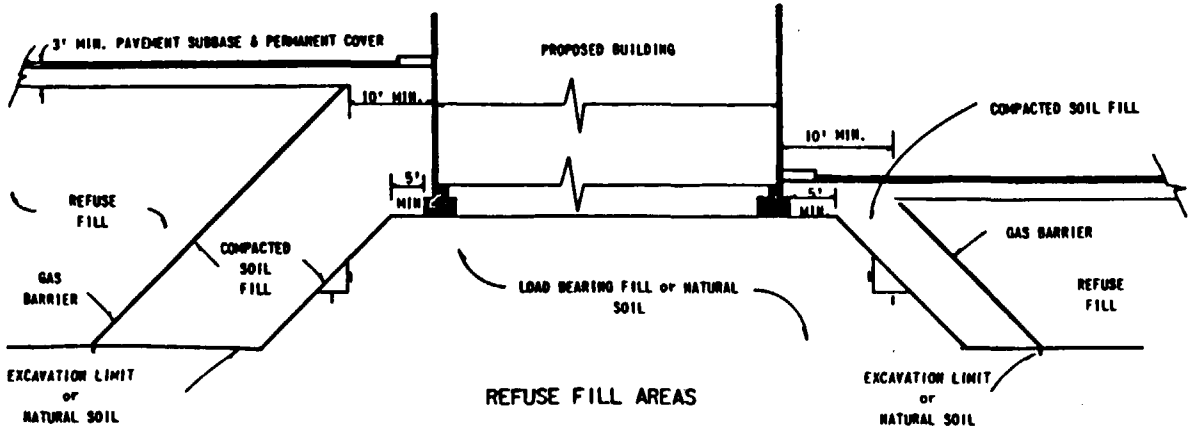
ALTERNATE A



ALTERNATE B



UTILITY CORRIDOR



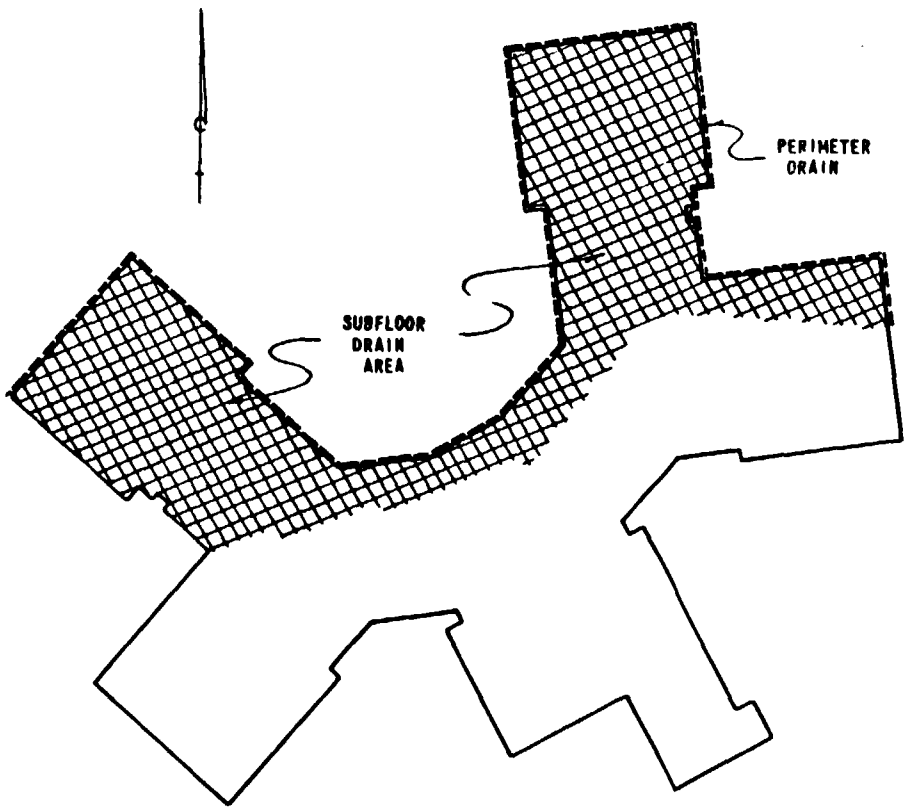
REFUSE FILL AREAS

BUILDING SITE PREPARATION
SEAVIEW SQUARE
OCEAN TOWNSHIP, NEW JERSEY

WOODWARD • GARDNER AND ASSOCIATES, INC.
CONSULTING ENGINEERS AND GEOLOGISTS

DRAWN BY: B. CORSON		DATE: 9/27/74
CHECKED :		JOB : 73P77

PLATE 10



SCALE IN FEET

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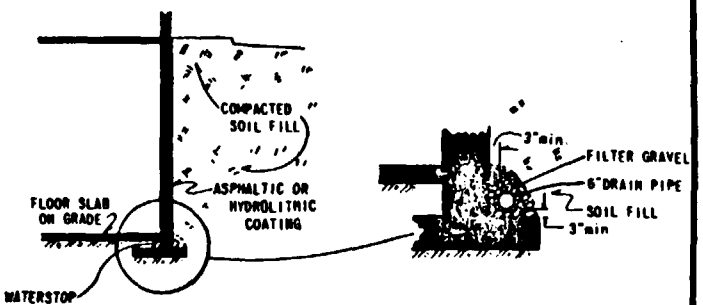
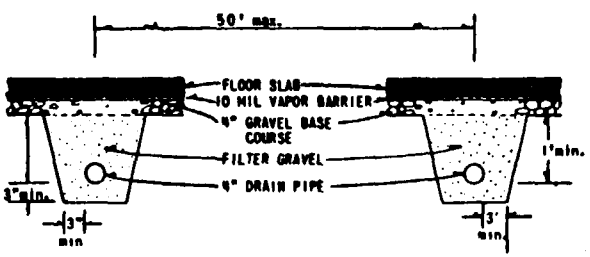


PERIMETER DRAIN



SUBFLOOR DRAIN

NOTES: FILTER GRAVEL SHOULD CONSIST OF CRUSHED STONE OR PROCESSED GRAVEL GRADED IN ACCORDANCE WITH THE NEW JERSEY DEPARTMENT OF TRANSPORTATION SPECIFICATIONS FOR NO. 1A OR 5A SOIL AGGREGATE MODIFIED SO THAT NOT MORE THAN 5% IS FINER THAN THE NO. 200 SIEVE

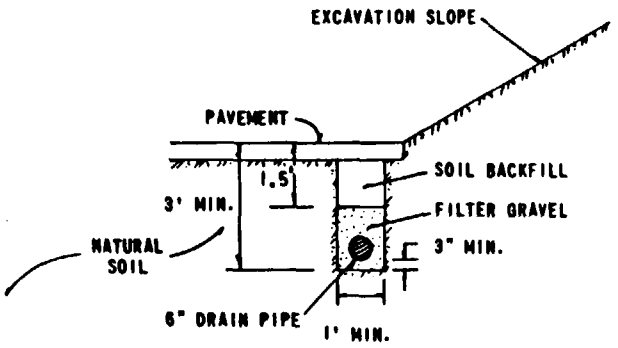
DRAIN PIPE SHOULD CONSIST OF PERFORATED PVC OR BITUMINOUS FIBER PIPE.

SUBSURFACE DRAINAGE
SEAVIEW SQUARE
OCEAN TOWNSHIP, NEW JERSEY

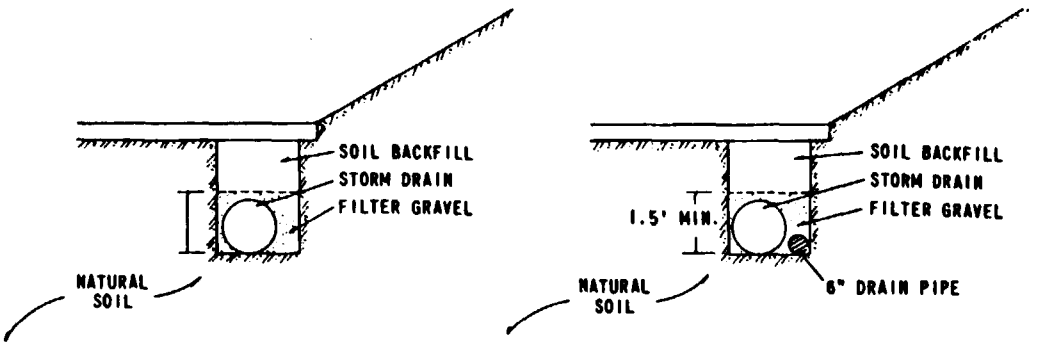
WOODWARD • GARDNER AND ASSOCIATES, INC.
CONSULTING ENGINEERS AND GEOLOGISTS

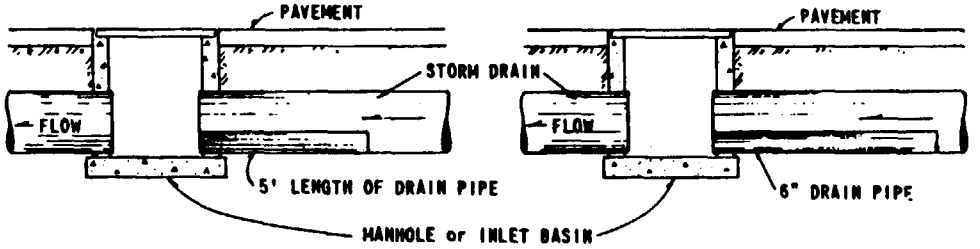
DRAWN BY: TP	SCALE In FEET AS SHOWN	DATE: 11/18-74
CHECKED :		JOB : 73 P 77

PLATE 11



PERIMETER DRAIN





ALTERNATE A- MANHOLES or INLET BASINS LESS THAN 200' APART.

ALTERNATE B

COMBINED PERIMETER DRAIN and STORM WATER DRAIN

NOTES:

FILTER GRAVEL shall consist of crushed stone or processed gravel graded in accordance with the New Jersey Dept. of Transportation specifications for No. 1A or 5A soil aggregate modified so that not more than 5% is finer than the No. 200 sieve.

DRAIN PIPE shall consist of perforated corrugated metal, PVC, Bituminous Fiber or porous concrete pipe.

ALL DRAIN PIPE shall be placed on a minimum gradient of 0.0015.

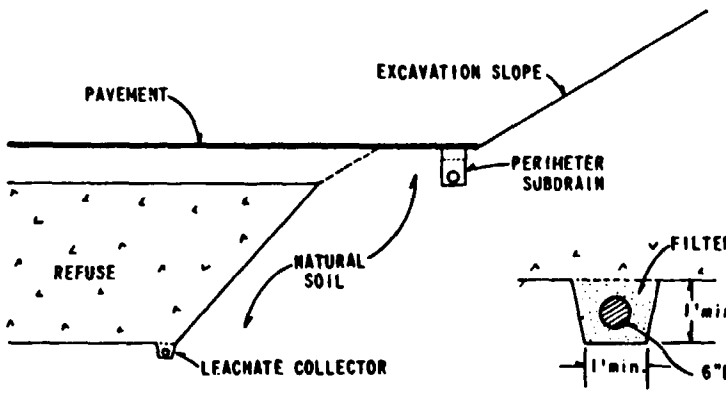
000318

SITE DRAINAGE
SEAVIEW SQUARE
Ocean Township, New Jersey

WOODWARD • GARDNER AND ASSOCIATES, INC.
CONSULTING ENGINEERS AND GEOLOGISTS

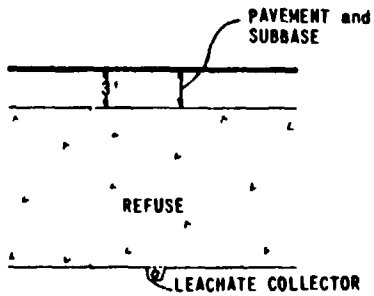
DRAWN BY: B CORSON		DATE: 11/27/74
CHECKED :		JOB : 73P77

PLATE 12

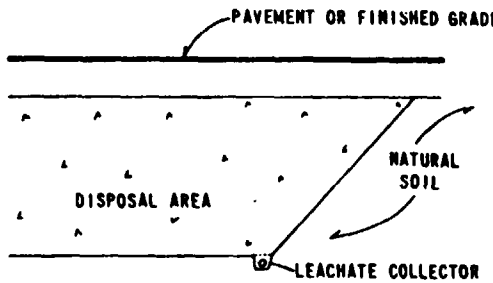


NORTHERN DISPOSAL AREAS

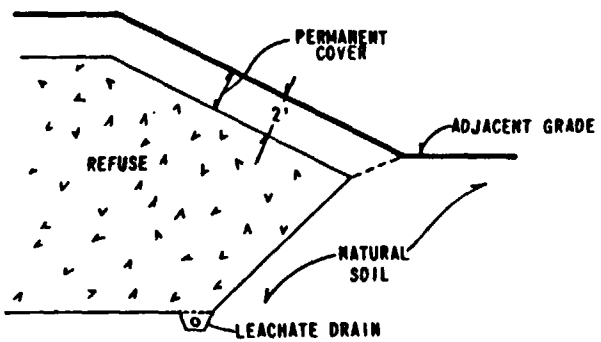
LEACHATE COLLECTOR



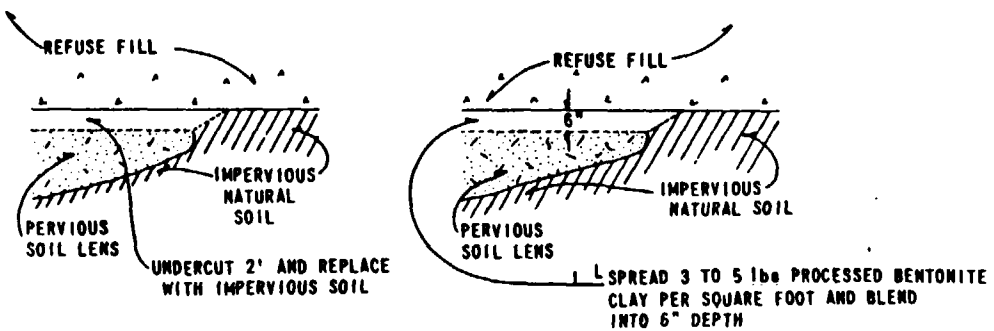
INTERIOR COLLECTOR



PERIMETER COLLECTOR



SOUTHERN DISPOSAL AREAS



PREPARATION OF BOTTOM OF DISPOSAL AREAS

TYPICAL INSTALLATIONS

NOTE: FILTER GRAVEL SHALL BE CRUSHED STONE OR PROCESSED GRAVEL MEETING THE NEW JERSEY DEPARTMENT OF TRANSPORTATION GRADATION REQUIREMENTS FOR NO.1A OR 5A SOIL AGGREGATE MODIFIED SO THAT NOT MORE THAN 5% IS FINER THAN THE NO.200 SIEVE.

DRAIN PIPE SHALL CONSIST OF PERFORATED PVC OR BITUMINOUS FIBER PIPE.

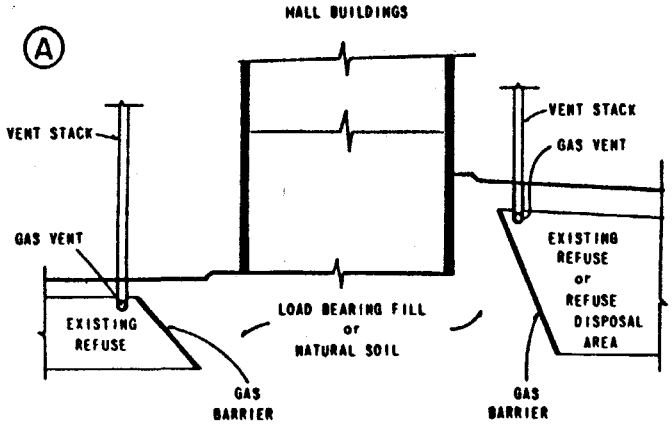
NATURAL SOIL AT BOTTOM OF REFUSE DISPOSAL AREAS CONTAINING LESS THAN 15% FINER THAN THE NO.200 SIEVE SHALL BE CLASSIFIED AS PERVIOUS.

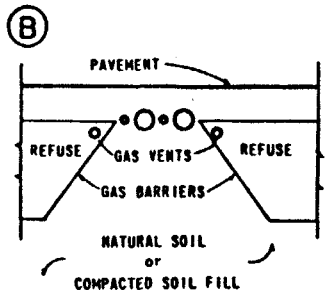
LEACHATE CONTROL
SEAVIEW SQUARE
OCEAN TOWNSHIP, NEW JERSEY

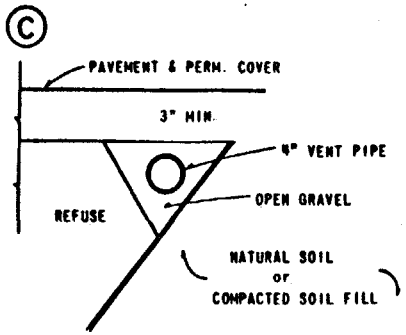
WOODWARD • GARDNER AND ASSOCIATES, INC.
CONSULTING ENGINEERS AND GEOLOGISTS

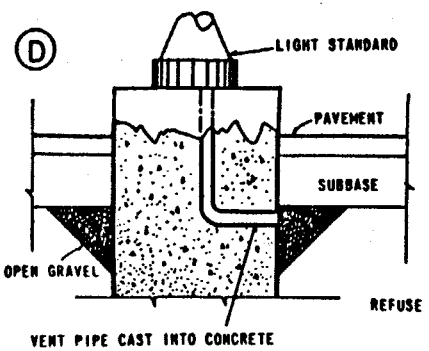
DRAWN BY: TP	SCALE in FEET NO SCALE	DATE: 11/18/74
CHECKED :		JOB : 73 P 77

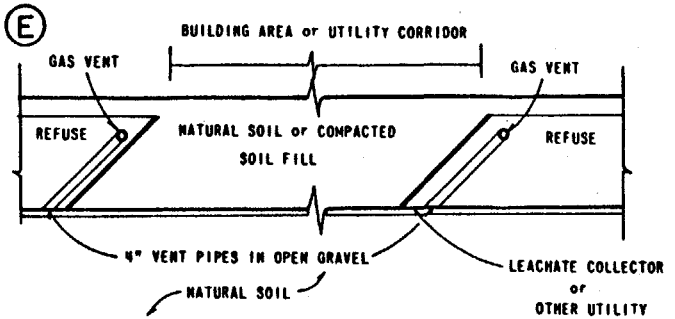
PLATE 13

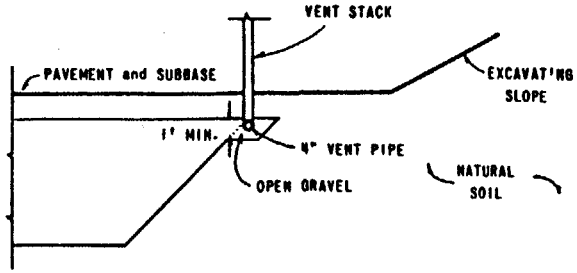












Ⓐ BUILDING PERIMETER
Ⓑ UTILITY CORRIDOR
Ⓒ GAS VENT DETAIL
Ⓓ GAS VENT AT LIGHT STANDARD
Ⓔ SUBSURFACE UTILITY CROSSING
Ⓕ SITE PERIMETER

NOTES:

VENT PIPE shall consist of perforated PVC or Bituminous Fiber pipe.

OPEN GRAVEL shall consist of crushed stone or processed gravel having a maximum size of 3/4" and not more than 10% finer than the No. 4 sieve.

VENT STACK shall consist of solid metal pipe extending at least 10' above pavement, located at exterior building corners and at 300' intervals along site perimeter.

GAS VENTING
SEAVIEW SQUARE
Ocean Township, New Jersey

WOODWARD • GARDNER AND ASSOCIATES, INC.
CONSULTING ENGINEERS AND GEOLOGISTS

DRAWN BY: B.CORSON		DATE: 11/20/74
CHECKED :		JOB : 73P77

APPENDIX

A

FIELD EXPLORATION

The subsurface conditions at the Seaview Square site were explored through three phases of field exploration. Initially, 12 test borings were drilled by J. E. Fritts & Associates, Inc. of Blackwood, New Jersey and refraction seismic poundings were made. The locations of these explorations were determined in the field by personnel from the Driller and Woodward-Gardner & Associates, Inc. and elevations were estimated from the site topographic map. The second phase consisted of 38 test borings drilled by Raymond International, Inc. of Hackensack, New Jersey. Eight borings were drilled by J. E. Fritts & Associates, Inc. in the third phase. The boring location and elevation survey for for these latter two phases was performed by Ackerman-Ney Associates of Freehold, New Jersey. Plate 2 shows the locations of all test borings and seismic soundings.

Soil samples for identifications and laboratory analysis were taken at three to five feet intervals by means of a two-inch O.D. split barrel sampler driven 18 inches by blows of a 140-lb. hammer falling 30 inches - the Standard Penetration Resistance Test. The number of hammer blows required for the last 12 inches, or fraction thereof, of sampler penetration are recorded on the boring logs. A "Key to Soil Symbols and Terms" used in this report is presented as page A-3. The results of the refraction seismic soundings are summarized on page A-3. The logs of the test borings are presented on pages A-4 through A-43.

Well-points with riser pipes were installed in some of the borings drilled in the first two phases to facilitate long term measurements of ground water levels. Measurements made in these observation wells are presented on the appropriate boring logs. Well-points with riser pipes were set in the phase three

borings. Impervious seals were then placed in the borings approximately ten feet above the well-points. Perforated riser pipes were then set above the impervious seals. The groundwater obsevations made in these eight borings are presented in section 1.4.2 of the report.

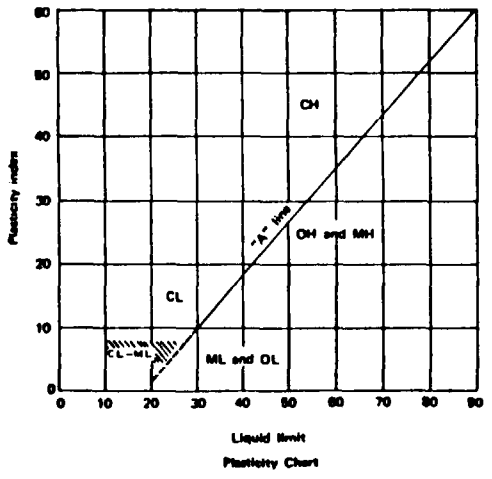
KEY TO SOIL SYMBOLS AND TERMS

Terms used in this report for describing soils according to thew texture or grain size distribution are in accordance with the Unified Soil Classification System, as described in Technical Memorandum No. 3-357, Waterways Experiment Station, March 1953.

Major Divisions		Group symbols	Typical names	Laboratory classification criteria
Coarse grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size) Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixture, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
		GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW
	Gravels with fines (Appreciable amount of fines)	GM* d / u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4
		GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7
				Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size) Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
		SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
	Sands with fines (Appreciable amount of fines)	SM* d / u	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4
		SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with P.I. less than 7
				Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols.
Fine-grained soils (More than half of material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		OL	Organic silts and organic silty clays of low plasticity	
	Silts and clays (Liquid limit greater than 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
		CH	Inorganic clays of high plasticity, fat clays	
		OH	Organic clays of medium to high plasticity, organic silts	
	Highly organic soils	Pt	Peat and other highly organic soils	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 per cent	GW, GP, SW, SP
More than 12 per cent	GM, GC, SM, SC
5 to 12 per cent	*Borderline* cases requiring dual symbols**



Plasticity Chart

Particle Size	Sieve Size			
	mm			#200 To #40
				#40 To #10
				#10 To #4
		< .005		
		.005 To .074		
				.074 To 0.42
				.42 To 2.00
				2.42 To 4.76
Material		Clay		
		Silt		
		Sand	Fine	
			Med.	
			Coarse	

Particle Size	Sieve Size		
	mm		
		#4 To 3/4 in.	
		3/4 in. To 3 in.	
	4.76 To 19.1	3 in. To 12 in.	
	19.1 To 76.2	12 in. To 36 in.	
	76.2 To 304.8		
	304.8 To 914.4		
Material			
Gravel	Fine		
	Coarse		
Cobbles			
Boulders			

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on No. 200 sieve): Includes (1) clean gravels and (2) silty or clayey gravels and sands. Condition is rated according to relative density.[1]

Descriptive Term	Relative Density
Very loose	0 to 15%
Loose	15 to 40%
Medium dense	40 to 70%
Dense	70 to 85%
Very dense	85 to 100%

FINE GRAINED SOILS (major portion passing No. 200 sieve): Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests.

Descriptive Term	Unconfined Compression Strength, tons/sq. ft.
Very soft	less than 0.25
Soft	0.25 to 0.50
Firm	0.50 to 1.00
Stiff	1.00 to 2.00
Very stiff	2.00 to 4.00
Hard	4.00 and higher

TEST AND SAMPLE IDENTIFICATION

15 — 15 – The number of blows (15) of a 140-pound hammer falling 30 inches used to drive a 2" O. D. split-barrel sampler for the last 12 inches of penetration.

50/2 — 50/2 – Number of blows (50) used to drive the split-barrel a certain number of inches (2).

P — Thin-wall tube sample.

P/250 — P250 – Thin-wall tube pushed hydraulically, using a certain pressure (250 psi) to push the last 6 inches.

C_1 — Denison or Pitcher-Type – core-barrel sample.

Ps — Ps – Piston sample.

A — Auger sample.

NX / 65 — BX – Rock cored with BX core barrel, which obtains a 1-5/8" diameter core.
NX – Rock cored with NX core barrel, which obtains a 2-1/8" diameter core.
65% – Percentage (65) of rock core recovered.

20 — 20% – Rock Quality Designation (RQD)[2]

VS — VS – Vane Shear Test.

Sample Recovered — Laboratory Test Performed:
C – Consolidation and specific gravity tests.
D – Maximum & minimum density.
DS – Direct Shear test.
G – Specific gravity test.
K – Permeability test.
M – Mechanical (sieve or hydrometer) analysis.
T – Triaxial compression test.
U – Unconfined compression test.
W – Unit weight & natural moisture content.
X – Special tests performed – see Laboratory test results.

Sample Not Recovered

(1) Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u used when L.L. is greater than 28.

** *Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols.* For example: GW-GC, well-graded gravel-sand mixture with clay binder.

(2) $RQD = \frac{\Sigma \text{Core Segments} > 4 \text{ Inches}}{\text{Core Interval}} \times 100$ Where Segmentation Is Not Caused By Drilling Effects

(1) ASTM 2049-69

LOG of BORING No. B-2

DATE 8/14/73 SURFACE ELEV. 70.0 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	Organic Content %
0								
		3			37.9			
5		7	Fill-Trash-paper, glass, cloth, wood- with layers of brown medium to fine sand		69.6			30.7
		6	wet at 10'		105.2			
10		29			115.2			23.1
15		11			107.6			
20		7			32.5			11.7
25		4			100.0			
30		13			88.2			16.5
35		15		32.0	66.3			
40		21	Medium dense gray silty sand	26.0	16.6			
45		12						

COMPLETION DEPTH _____ Water Depth _____ Date _____

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-1

DATE 8/9/73 SURFACE ELEV. 78.0 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Loose brown medium to fine sand	74.5				
		2						
5		2	Fill-Trash-rags, wood, paper, glass- with layers of sand					
		6						
10		7						
15		7		58.0				
20		9	Medium dense gray silty fine sand					
25		20		50.0				
30		27	Dense gray sandy silt	45.0				
35		24	Medium dense gray silty fine sand	40.0				
40		43	Dense gray sandy silt	36.5				
			Well point and riser pipe installed					
45								

COMPLETION DEPTH 41.5' Water Depth 18.8' Date 8/9/73

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

A-4

LOG of BORING No. B-3

DATE 8/21/74 SURFACE ELEV. 58.0 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		5	Fill--Trash-rags, glass, and metal-with layers of sand					
5		6						
		6						
10		27						
15		11						
20		12		33.0				
25		33	Dense gray fine to medium sand					
30		31		25.0				
35		38	Dense gray silt with layers of medium sand					
40		32						
45				11.5				

COMPLETION DEPTH 46.5 Water Depth 27.5 Date completion
SAMPLER: 2" O.D. SPLIT BARREL SAMPLER Encountered water at 24'

LOG of BORING No. P-2 (cont)

DATE 8/14/73 SURFACE ELEV. LOCATION

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45		12	Medium dense gray silty sand with layers of medium sand					
50		21						
55		22		12.0				
60		20	Medium dense gray brown silty sand	8.5				
65			Offset borings that met refusal B-2A-refusal at 16' B-2B-refusal at 4' B-2C-refusal at 18' entangled auger in bed springs at 15' in B-2C					

COMPLETION DEPTH 61.5' Water Depth caved Date
SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

A-5

LOG of BORING No. B-5

DATE 8/11/73 SURFACE ELEV. 82.0 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		4						
5		5	Fill-Trash-rags, wood, glass, and metal- with sand layers					
		6						
10		5						
15		5						
20		16	wet at 25'					
25		11						
30		30						
				47.0				
35		20	Medium dense gray silty fine sand					
40		22						
				39.0				
45		28	Medium dense gray sandy silt with fine sand layers					

COMPLETION DEPTH _____ Water Depth _____ Date _____

SAMPLER: 3" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-4

DATE 8/5/73 SURFACE ELEV. 59.0 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	Organic Content, %
0		2	Fill-layers of trash and gravelly sand		46.3			
5		4			18.1			2.9
10		4			33.9			
		7			53.2			16.2
15		5			49.3			14.4
				39.0				
20		33			20.3			
25		29	Medium dense to dense dark gray gravelly silty sand		16.7			
30		10			20.3			
				19.0				
40		24	Stiff brown and red sandy clay	17.5				
45								

COMPLETION DEPTH 41.5' Water Depth 19.0' Date completion

SAMPLER: 3" O.D SPLIT BARREL SAMPLER

A-6

JOB # 73 P 77

LOG of BORING No. B-6

DATE 8/11/73 SURFACE ELEV. 70.0 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	Organic Content, %
0		17			20.2			
5		8			48.4			6.0
		7			57.9			
10		10	Fill-Trash-rags, wood, glass, metal--with sand layers		69.2			
15		8			56.2			17.2
20		7			95.2			
25		6			32.3			7.2
30		32			82.5			
35		15	Wet at 35'		22.8			4.6
				31.0				
40		26	Medium dense gray silty fine sand		28.5			
45		22			28.0			

COMPLETION DEPTH _____ Water Depth _____ Date _____

SAMPLER: 3" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-5 (cont.)

DATE _____ SURFACE ELEV. _____ LOCATION _____

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45		28						
			Medium dense gray sandy silt with fine sand layers					
50		33						
55		30		25.5				
60								

COMPLETION DEPTH 56.5' Water Depth caved Date _____

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-7

DATE 8/6/73 SURFACE ELEV. 50.0 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0								
		6						
5		8	Fill-Trash-paper, wood, glass, rags-with layers of sand					
		5						
10		6						
15		12						
20		8						
25		9						
				21.0				
30		19	Hard gray clayey silt with layers of medium sand					
35		38		12.0				
			Medium dense to very dense gray sand-- becoming friable sandstone					
40		20						
45		100/6"		4.0				

COMPLETION DEPTH _____ Water Depth _____ Date _____

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-6 (cont.)

DATE _____ SURFACE ELEV. _____ LOCATION _____

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
50		22	Medium dense gray silty fine sand	21.0				
		23	Stiff black sandy clayey silt					
55		27		13.0				
60		14	Medium dense gray silty sand	8.5				
65								

COMPLETION DEPTH 61.5' Water Depth caved Date _____

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

A-8

LOG of BORING No. B-8

DATE 8/5/73 SURFACE ELEV. 46.0 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Brown sand	45.0				
5		2	Fill-Trash-metal, glass, wood, wire-with layers of dark gray-brown gravelly sand					
		2						
10		WOR 9						
15		2		30.0				
		8	Medium dense dark gray fine to coarse sand with silty clay seams					
20		6" 30						
25		15		19.0				
			Stiff green black sandy clay					
30		18						
35		20		9.5				
40								
45								

COMPLETION DEPTH 36.5' Water Depth 2.0' Date completion

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-7 (cont.)

DATE 8/6/73 SURFACE ELEV. LOCATION

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45		100/6						
			Stiff green silty sandy clay					
50		31		-1.5				
			Encountered water at 16'					
55								

COMPLETION DEPTH 51.5 Water Depth caved Date

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

A-9

LOG of BORING No. B-12

DATE 8/6/73 SURFACE ELEV. 37.0 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Brown sand	36.0				
		6	Firm brown to red brown clayey silt					
5		7		30.0				
		19	Stiff gray clayey silt with fine sand layers					
10		20		23.0				
15		19	Medium dense gray coarse sand	17.0				
20		50	Medium dense to very dense green sandy silt with broken sandstone					
25		19		10.5				
			Encountered water at 12'					
30								

COMPLETION DEPTH 26.5' Water Depth 8' Date Completion

SAMPLER: 3" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-11

DATE 8/22/73 SURFACE ELEV. 34.0 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		7	Fill-Miscellaneous trash and brown gray sand	30.0				
5		13	Medium dense brown gray gravelly coarse to fine sand					
		24						
10		26		19.0				
15		67	Medium dense to very dense green gray sandy clayey silt					
20		22						
25		26		7.5				
			Encountered water at 5'					
			Water level at completion with augers in 17'					
30			Water level at completion with augers out 1.5'					
35								
40								
45								

COMPLETION DEPTH 26.5' Water Depth Date

SAMPLER: 3" O.D. SPLIT BARREL SAMPLER

A-11

LOG of BORING No. B-13 continued

DATE 3/15-18/74 SURFACE ELEV. 89.50 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45				42.5				
50		38	Dense brown and gray alternating thin layers of fine sand and clayey silt.		22.7			
55		47		32.5	26.8			
60		45	Hard grayish brown clay, trace silt		37.3			
65		48		24.0	36.0			
70			Encountered water at 27.5 feet while drilling Installed wellpoint at elevation 24.0					

Date	Water Depth	Water Elevation
3/19	54.3'	35.2
3/20	51.2'	38.3
3/22	47.8'	41.7
5/13	38.5'	51.0
8/ 6	38.8'	50.7

COMPLETION DEPTH 65.5 ft. Water Depth 48.5 ft. Date 3/18/74

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-13

DATE 3/15 - 3/18/74 SURFACE ELEV. 89.50 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		5	Fill: Loose yellow-brown silty fine to medium sand with 15 to 50% of paper, plastic, glass and wood.					
5		8						
10		6		79.5				
15		11	Fill: Medium dense brown silt, trace of clay with 30 to 65% of metal, paper, wood, glass and plastic.					
20		20						
25		19						
30		24		62.0				
35		16	Fill: Medium dense black organic silt with 25 to 75% of paper, wood, plastic, metal and cinders.					
40		30						
45		41						
		30						

COMPLETION DEPTH 65.5 ft. Water Depth 48.5 ft. Date 3/18/74

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

A-12

LOG of BORING No. B-15

DATE 3/13/74 SURFACE ELEV. 69.0 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0								
		4	Fill: Loose brown to gray fine to medium sand, trace silt with 15 to 85% paper, glass, plastic.					
5		6						
		6						
10		13	plant remains and traces of gravel.	56.5				
		4	Fill: Loose black sandy silt, traces of plant fragments and organic odor.	51.0	110.4			
20		18	Fill: Black peat with silt lens	46.0	166.0			
25		11	Loose grey fine to medium sand, traces of silt and fine gravel.	40.0	23.5			M
30		19	Very stiff and hard gray to brown silty clay with fine sand lens, trace of mica		36.1			
35		35			40.6			
40		24		28.5	36.7			
			Encountered water at 14' while drilling					
45			Water Depths: 3/13 —; 3/14 21.6'; 3/15 22.8'; 3/18 21.6'; 3/19 21.5'; 3/20 21.6'; 3/22 21.6'; 5/13 20.4'; 8/6 14.0'					

COMPLETION DEPTH 40.5 ft. Water Depth 29.5 ft. Date 3/13/74

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-14

DATE 3/6-7/74 SURFACE ELEV. 62.6 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Light brown medium sand with fine gravel.	61.6				
		21	Medium dense light gray silty sand.	57.1				
5		23						
		27						
10		18	Very stiff to hard gray silty clay with some fine sand lenses.					
15		40						
20		34		42.1				
25			Encountered water at 2' while drilling Wellpoint installed at elevation 42.6 ft.					

Date	Water Depth	Water Elevation
3/13	3.2'	59.4
3/14	3.0'	59.6
3/15	3.0'	59.6
3/18	3.0'	59.6
3/19	3.1'	59.5
3/20	3.0'	59.6
3/22	3.0'	59.6
5/13	2.6'	60.0
8/6	3.8'	58.8

COMPLETION DEPTH 20.5 ft. Water Depth 7.9 ft. Date 3/7/74

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-17

DATE 3/8/74 SURFACE ELEV. 86.3 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0								
		18	Fill: Medium dense black and brown becoming black silty sand with 50 to 75% paper, wood and metal.					
5		17						
		18						
10		11						
15		33						
		210/6"	Temparature increases from 75° F to 85° F at 11'.					
20								
25		111						
		17						
30								
		18		49.3				
35			Dense brown and gray silty fine sand.					
40		32						
45		41						

COMPLETION DEPTH 60.5 ft. Water Depth 36.0 Date 3/18/74

SAMPLER: 3" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-16

DATE 3/15/74 SURFACE ELEV. 52.1 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0								
		24	Fill: Medium dense gray fine to medium sand, some fine gravel and glass with silty clay lenses.	49.1				
5		5	Loose dark gray and yellowish brown to dark brown fine sand, trace of silt.					
		9		42.1				
10		6						
15		20	Firm to hard gray and dark brown alternating lenses of clayey silt and fine sand, occasionally medium sand.					
20		50						
25		19		25.6				
30			Encountered water at 3'while drilling Date / Water Depth / Water Elevation 3/18 0.5' 51.6 3/19 0.5' 51.6 3/20 0.5' 51.6 3/22 0.4' 51.7					
35								
40								
45								

COMPLETION DEPTH 26.5 ft. Water Depth 3.5 ft. Date 3/15/74

SAMPLER: 3" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-18

DATE 3/8-11/74 SURFACE ELEV. 82.1 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0								
5		12	Fill: Loose to dense black and brown to black refuse including rags, tin cans, wood fragments, glass, steel wool, fiberglass. Traces of sand, increasing temperature with depth.					
		18						
10		21						
		24						
15		11						
20		63						
25		123						
30		58						
35		11		44.1				
40		29	Fill: Firm gray clayey silt with fine sand lenses and traces of refuse					
45		20						

COMPLETION DEPTH 60.5 ft. Water Depth 37.3 ft. Date 3/11/74

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-17 continued

DATE 3/8/74 SURFACE ELEV. 86.3 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45			Dense brown and gray silty fine sand.	36.3				
50		23						
55		36	Hard dark gray silty clay.	25.8				
60		41						
65			Encountered water at 30' while drilling					

Date	Water Depth	Water Elevation
3/13	24.0'	62.3
3/14	28.5'	57.8
3/18	29.8'	56.5
3/19	29.7'	56.6
3/20	20.0'	66.3
3/22	20.3'	66.0

COMPLETION DEPTH 60.5 ft. Water Depth 36.0 Date 3/8/74

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-18

DATE 3/8-11/74 SURFACE ELEV. 82.1 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0								
		12						
5		18						
		21						
10		24	Fill: Loose to dense black and brown to black refuse including rags, tin cans, wood fragments, glass, steel wool, fiberglass. Traces of sand, increasing temperature with depth.					
15		11						
20		63						
25		123						
30		58						
35		11		44.1				
40		29	Fill: Firm gray clayey silt with fine sand lenses and traces of refuse					
45		20						

COMPLETION DEPTH 60.5 ft. Water Depth 37.3 ft. Date 3/11/74

SAMPLER: 3" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-17 continued

DATE 3/8/74 SURFACE ELEV. 86.3 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45								
			Dense brown and gray silty fine sand.	36.3				
50		23						
			Hard dark gray silty clay.					
55		36						
				25.8				
60		41						
65								

Encountered water at 30' while drilling

Date	Water Depth	Water Elevation
3/13	24.0'	62.3
3/14	28.5'	57.8
3/18	29.8'	56.5
3/19	29.7'	56.6
3/20	20.0'	66.3
3/22	20.3'	66.0

COMPLETION DEPTH 60.5 ft. Water Depth 36.0 Date 3/8/74

SAMPLER: 3" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-19

DATE 3/18/74 SURFACE ELEV. 50.0 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0								
		2	Very loose brown silty fine to medium sand with root fragments.					
5		3		43.0				
		16						
10		18	Medium dense gray and brown alternating lenses of clayey silt and fine sand, medium to coarse sand lenses past 14.5'.					
15		26						
20		19		27.5				
		21	Medium dense gray and brown alternating lenses of clayey silt with lenses of fine sand, traces of mica.					
25								
30		25		19.5				
			Encountered water at 1.3' while drilling					
35								

Date	Water Depth	Water Elevation
3/19	1.6'	48.4
3/20	1.6'	48.4
3/22	1.5'	48.5

COMPLETION DEPTH 30.5 ft. Water Depth 1.5 ft. Date 3/18/74

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-18 continued

DATE 3/8-11/74 SURFACE ELEV. 82.1 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45								
			Fill: Firm gray clayey silt with fine sand lenses and traces of refuse					
50		30			27.6			
				29.1				
55		46	Dense to very dense gray silty fine to medium sand.		25.6			
60		65		21.6	18.9			
65			Encountered water at 40' while drilling Well point installed at elevation 21.5'					

Date	Water Depth	Water Elevation
3/13	41.1'	41.0
3/14	39.4'	42.7
3/15	38.8'	43.3
3/18	36.8'	45.3
3/19	36.7'	45.4
3/20	38.9'	43.2
3/22	37.0'	45.1
5/13	36.6'	46.5
8/ 6	36.1	46.0

COMPLETION DEPTH 60.5 ft. Water Depth 37.3 ft. Date 3/11/74

SAMPLER 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-21

DATE 3/13/74 SURFACE ELEV. 54.2 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Topsoil	54.0				
5		5 3	Loose yellowish brown fine sandy silt with some clay past 5'	46.7				
10		22 21	Medium dense brown and gray clayey silt with sand lenses					
15		22						
20		26		33.7				
25			Encountered water @ 3' while drilling Installed wellpoint @ elevation 33.7					

Date	Water Depth	Water Elevation
3/14	14.2'	40.0
3/15	12.3'	41.9
3/18	9.0'	45.2
3/19	9.0'	45.2
3/20	9.0'	45.2
3/22	7.8'	46.4
5/13	7.3'	46.9
8/6	9.1'	45.1

COMPLETION DEPTH 20.5 ft. Water Depth 4.5 ft. Date 3/13/74

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-20

DATE 3/14/74 SURFACE ELEV. 55.9 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		7	Loose yellowish brown fine sand, trace silt	52.9	23.3			
5		3	Soft gray and yellowish brown silty clay, traces of fine sand	48.4	29.5	33	29	
10		5 8	Loose dark gray to yellowish brown clayey silt with lenses of fine sand	42.9	32.6 37.6			
15		17	Medium dense brown silty fine sand with gray clayey silt lenses		32.3			
20		21		35.4	36.7			
25			Encountered water @ 7.5' while drilling					

Date	Water Depth	Water Elevation
3/15	5.4'	50.6
3/18	4.5'	51.4
3/19	4.8'	51.1
3/20	4.9'	51.0
3/22	3.4'	52.5

COMPLETION DEPTH 20.5 ft. Water Depth 7.4' Date 3/14/74

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-23

DATE 3/11/74 SURFACE ELEV. 80.8 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Fill: Medium dense silty sand, some paper and wood fragments.	77.8				
5		14						
		89	Fill: Very hard and hard dark gray silty clay with 20% wood fragments and packing material.	70.8				
10		47						
		34						
15		43	Fill: Dense dark gray sandy silt with 75% paper, wood and rags.					
20		24						
				55.8				
25		30	Fill: Very stiff dark gray silty clay with 50% wood fragments.	52.8				
30		14	Fill: Medium dense, gray and brown fine sand with 10% glass and plastic.		58.1			
35		19			27.4			M
40		21			32.6			
				38.8				
45		17	Medium dense gray and brown silty fine sand.		32.0			

COMPLETION DEPTH 50.5 ft. Water Depth 21.2 ft. Date 3/11/74

SAMPLER: 3" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-22

DATE 3/6/74 SURFACE ELEV. 53.0 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		9	Fill: Loose light brown medium sand	49.0				
5		4	Fill: Loose brown silty medium sand, some fine gravel with traces paper @ 7'	44.5				
10		5	Fill: Loose brown and green medium sand mixed with lumps of silt and clay	41.0				
15		20	Very stiff to firm dark brown silty clay with fine to medium sand lenses past 19'		42.1	95	62	
20		10			27.1			
25		6		27.5	19.8	NP	30	
30		14	Medium dense dark gray medium to coarse sand		17.7			
35		17		17.5				
40			Encountered water @ 10' while drilling					

Date	Water Depth	Water Elevation
3/13	4.6'	48.4
3/15	4.6'	48.4
3/18	4.7'	48.3
3/19	4.7'	48.3
3/20	4.7'	48.3
3/22	4.6'	48.4

COMPLETION DEPTH 35.5 ft. Water Depth 6.4 ft. Date 3/6/74

SAMPLER: 3" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-24

DATE 3/14/74 SURFACE ELEV. 50.7 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Loose brown clayey silt with root fragments and organic odor.	48.2	22.5			
		5	Stiff yellow silty clay, traces fine sand.		29.8			
5		10		44.0				
		21	Very stiff brown and grey clayey silt with lenses of fine sand.	40.2	30.6			
10		21	Medium dense gray fine sand, traces of silt and mica.	37.7	27.2			
15		20	Very stiff dark brown clayey silt with lenses of fine sand to 16.5'.		34.5			
20		23		30.2	35.0			
25			Encountered water at 3.0' while drilling					

Date	Water Depth	Water Elevation
3/15	3.4'	47.3
3/18	2.4'	48.3
3/19	2.4'	48.3
3/20	2.4'	48.3
3/22	1.4'	49.3

COMPLETION DEPTH 20.5 ft. Water Depth 4.7 ft. Date 3/14/74

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-23 continued

DATE 3/11/74 SURFACE ELEV. 80.8 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45			Medium dense gray and brown silty fine sand					
50		31		30.3				
55			Encountered water at 28' while drilling					
60								

Date	Water Depth	Water Elevation
3/13	8.5'	72.3
3/14	16.0'	64.8
3/15	15.8'	65.0
3/18	15.5'	65.3
3/19	15.5'	65.3
3/20	15.5'	65.3
3/22	15.5'	65.3

COMPLETION DEPTH 50.5 ft. Water Depth 21.2 ft. Date 3/11/74

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-25 continued

DATE 3/19/74 SURFACE ELEV. 76.6 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45								
50		40	Very dense to medium dense grey silty medium to coarse sand.					
55		17						
60		22		16.1				
65			Encountered water at 29' while drilling Date / Water Depth / Water Elevation 3/20 / 27.1' / 49.5 3/22 / 26.3' / 50.3					

COMPLETION DEPTH 60.5 ft. Water Depth 41.0 ft. Date 3/19/74

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-25

DATE 3/19/74 SURFACE ELEV. 76.6 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		14	Fill: Medium dense brown silty fine to medium sand with little paper and little wood.	72.6				
5		26						
10		15	Fill: Medium dense to dense dark brown organic silt with 10 to 65% plastic paper, wood, glass and metal.					
15		21 100/2"						
20		27						
25		40						
30		14	Gas escaped from hollow stem auger after drilling to 29', temperature of samples imcreases with depth.					
35		25		37.4				
40		15	Medium dense brown and grey clayey silt with lenses of fine sand.	34.1				
45		65	Very dense to medium dense gray silty medium to coarse sand					

COMPLETION DEPTH 60.5 ft. Water Depth 41.0 ft. Date 3/19/74

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-26 continued

DATE 3/20/74 SURFACE ELEV. 67.3 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45				20.3				
			Hard grey-green sandy clayey silt	16.8				
50		31						
			Encountered water at 11' while drilling Date 3/22 — Water Depth 12.2' — Water Elevation 55.1					
55								

COMPLETION DEPTH 50.5 ft. Water Depth 38.5 ft. Date 3/20/74

SAMPLER: 3" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-26

DATE 3/20/74 SURFACE ELEV. 67.3 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		8						
5		4	Fill: Loose yellowish brown clayey sandy silt with 30 to 85% paper, wood, plastic, leaves.					
		73/7"						
10		10		54.3				
15		71	Fill: Loose to dense black organic silt with 60 to 80% of wood, plastic, glass, paper.					
20		20	Past 13' gas escaped from hollow stem augers, temperature increasing with depth.					
25		5						
				37.6				
30		27	Very stiff brown and grey clay with medium sand lenses.	35.3	40.5			
35		19	Medium dense grey and brown medium to coarse sand, trace of silt with clayey silt lenses.		26.6			M
40		10			19.8			
45		19			12.8			

COMPLETION DEPTH 50.5 ft. Water Depth 38.5 ft. Date 3/20/74

SAMPLER: 3" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-28

DATE 3/20-21/74 SURFACE ELEV. 42.2 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Loose black fine sand, trace of silt with some root fragments	39.4				
		5						
5			Loose yellow fine sandy silt, trace clay	36.2				
		9						
		17			40.7	89	50	
10			Medium dense brown and gray clayey silt with fine sand lenses					
		15			35.6			
		23		24.7				
15			Medium dense gray mediun to coarse sand, trace silt with clayey silt lenses	21.7				
20		19						
			Encountered water @ 3' during drilling Installed wellpoint at elevation 21.7					
25								

Date	Water Depth	Water Elevation
3/22	13.2'	29.0
5/13	8.8'	33.4
8/ 6	9.1'	33.1

COMPLETION DEPTH 20.5 ft. Water Depth 0.5' Date 3/21/74

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-27

DATE 3/14/74 SURFACE ELEV. 44.7 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Fill: Loose dark brown fine to medium sandy silt with fine gravel and 10% paper and glass.	40.7	31.5			
		5						
5			Soft brown clayey silt with fine to medium sand.	37.2	40.3			
		4						
		15			31.9			
10			Very stiff brown and black clayey silt with very fine sand lenses and traces of mica.					
		16			33.4			
15		22			24.7			
20		23		24.2	38.3			
			Encountered water at 4' while drilling					
25								
30								

Date	Water Depth	Water Elevation
3/15	2.6'	42.1
3/18	2.0'	42.7
3/19	1.8'	42.9
3/20	1.7'	43.0
3/22	1.3'	43.4
5/13	3.0'	41.7

COMPLETION DEPTH 20.5 ft. Water Depth 3.0 ft. Date 3/14/74

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-30

DATE 3/14/74 SURFACE ELEV. 35.9 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Brown humus	35.6				
		5	Loose brown clayey silt, trace fine to medium sand		47.0			
5		6		29.9	22.2			
			Grey silty clay with medium to coarse sand	28.4				
		14	Medium dense grey medium to coarse sand, trace silt.	25.9	19.1			
10		20	Very stiff brown and grey silty clay with medium to coarse sand lenses.	22.9	24.1			
15		23	Medium dense grey medium to coarse sand, trace silt.					
20		27		15.4				
25			Encountered water at 0.5' while drilling Installed well point at Elevation 15.4'					

Date	Water Depth	Water Elevation
3/15	18.7'	17.2
3/18	18.4'	17.5
3/19	18.0'	17.9
3/20	16.5'	19.4
3/22	15.6'	20.3
5/13	2.3'	33.6
8/ 6	0.0'	35.9

COMPLETION DEPTH 20.5 ft. Water Depth 0.0 ft. Date 3/14/74

SAMPLER 2" O D SPLIT BARREL SAMPLER

LOG of BORING No. B-29

DATE 3/6/74 SURFACE ELEV. 46.1 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Fill; Brown and black medium sand and cinders.	45.1				
		28						
5		30	Very stiff gray silty clay, trace fine sand					
		25		36.1				
10		17						
15		17	Medium dense grey medium to coarse sand, trace silt.					
20		21		25.6				
25			Encountered water at 3' while drilling					

*Date	Water Depth	Water Elevation
3/13	1.0'	45.1
3/14	1.0'	45.1
3/18	1.0'	45.1
3/19	1.0'	45.1
3/20	1.0'	45.1
3/22	1.0'	45.1

COMPLETION DEPTH 20.5 ft. Water Depth 4.1 ft. Date 3/6/74

SAMPLER 2" O D SPLIT BARREL SAMPLER

LOG of BORING No. B-32

DATE 3/20/74 SURFACE ELEV. 42.0 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Mulch	41.6				
5		9	Loose yellow and brown silt, trace clay, trace fine sand and root fragments to 2.5'.					
		4		35.0	37.6			
10		20	Very stiff brown and grey silty clay with fine sand lenses.					
		18			33.2			
15		14			32.8			
				24.5				
20		16	Medium dense gray medium to coarse sand	21.5				
25			Encountered water at 1.5' while drilling					

Date	Water Depth	Water Elevation
3/22	1.8'	40.2

COMPLETION DEPTH 20.5 ft. Water Depth 7.5 ft. Date 3/20/74

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-31

DATE 3/12/74 SURFACE ELEV. 48.1 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0								
5		42						
		36						
10		23	Fill: Dense to medium dense brown silty sand with up to 50% wood fragments and/ or brick fragments.					
		27						
15		22						
				29.1				
20		17	Medium dense grey silty fine sand.		26.0			
					27.8			
25		20		20.1				
30		51	Dense dark green medium to coarse sandy silt with small rock fragments.		32.7			
					24.2			
35		34						
40		43		7.6	26.0			
45			Encountered water at 18' while drilling Installed well point at elevation 7.6'					

Date	Water Depth				
3/13	28.4'	3/18	20.5'	5/13	16'
3/14	25.5'	3/19	19.7'	8/ 6	16.7'
3/15	23.8'	3/20	19.7'		

COMPLETION DEPTH 40.5 ft. Water Depth 34.0 ft. Date 3/12/74

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-32

DATE 3/18/74 SURFACE ELEV. 79.8 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		5	Fill: Loose, medium dense and dense brown to black silty fine to medium sand with 15 to 60% plastic, paper, wood, metal, glass and cinders					
5		12						
		8						
10		10						
		8						
15								
		50						
20								
		34						
25								
		29						
30				45.8				
		22	Very stiff to hard brown and gray silty clay with sand lenses, percentage of sand increasing with depth					
35								
		37						
40								
		40						
45								

COMPLETION DEPTH 55.5 ft. Water Depth 43.0 ft. Date 3/18/74

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-33

DATE 3/13/74 SURFACE ELEV. 54.6 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Topsoil	54.5				
		3						
5		2	Fill: Loose gray fine to medium sand, trace silt with 25% glass, paper and wood.					
		7						
10				43.1				
		11	Medium dense black fine to medium sand silt, traces of plant, organic odor.	41.6				
15		20	Medium dense brown clayey silt with fine sand lenses.					
				34.8				
20		15						
			Medium dense and dense grey fine to medium sand, trace fine gravel with sandy silt lenses past 25'.					
25		58						
30		29		23.1				
			Encountered water at 1.5 ft. while drilling					
35								

Date	Water Depth	Water Elevation
3/14	2.5'	52.1
3/15	2.5'	52.1
3/18	2.3'	52.3
3/19	2.2'	52.4
3/20	2.2'	52.4
3/22	2.1'	52.5

COMPLETION DEPTH 31.5 ft. Water Depth 2.4 ft. Date 3/13/74

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-33

DATE 3/15/74 SURFACE ELEV. 102.3 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		4	Fill: Loose black and gray fine to medium sand, little gravel with 40% to 95% paper and wood					
5		4						
10		100/6"						
		125/8"		90.3				
15		38	Fill: Loose, medium dense to dense black organic silt with 25% to 65% wood, glass, paper, plastic and metal					
20		44						
25		11						
30		22						
35		28						
40		36		60.8				
45		49	Hard gray fine sandy clay with fine sand lenses					

COMPLETION DEPTH 60.5 ft. Water Depth 43.7 ft. Date 3/15/74

SAMPLER: 3" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-34 Continued

DATE 3/18/74 SURFACE ELEV. 79.8 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45				30.1				
50		38	Very dense gray medium to coarse sand					
55		57		24.3				
60			Encountered water at 30' while drilling					

Date	Water Depth	Water Elevation
3/19	36.9'	52.9
3/20	26.2'	53.6
3/22	28.2'	51.6

COMPLETION DEPTH 55.5 ft. Water Depth 43.0 ft. Date 3/18/74

SAMPLER: 3" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-36

DATE 3/12/74 SURFACE ELEV. 86.0 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		13	Fill: Medium dense light brown medium to coarse sand with paper and wood fragments	83.0	10.8			
5		12	Fill: Medium dense light green fine sand with trace paper	79.0	17.1			
10		7	Loose light brown medium to coarse sand, trace silt with fine gravel	75.0	15.5			
15		3	Loose to medium dense tan and white fine sandy silt with clayey silt lenses past 13'		26.2			
		6			27.2			
					25.2			
20		24		63.0				
25		29	Medium dense light gray fine sand trace silt	58.0	23.0			
30		38	Hard dark gray silty clay with fine sand lenses and trace of mica	52.5	39.0			
35		47	Dense gray fine to medium sand, some fine gravel with 3" silty clay lenses	46.2	19.7			
40		68	Very dense gray fine sandy silt with 2" gravelly sand lenses	42.0	24.4			
45		67						

COMPLETION DEPTH 55.5 ft. Water Depth 41.5 ft. Date 3/13/74

SAMPLER: 3" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-36 Continued

DATE 3/15/74 SURFACE ELEV. 102.3 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45				54.8				
50		51	Very dense gray fine to medium sand, trace silt with silt lenses					
55		48		45.3				
60		54	Hard gray and brown silty clay, trace mica with medium to coarse sand lenses	41.8				

Encountered water at 12' while drilling

Date	Water Depth	Water Elevation
3/18	24.1'	78.2
3/19	24.0'	78.3
3/20	24.1'	78.2
3/22	24.1'	78.2

COMPLETION DEPTH 60.5 ft. Water Depth 43.7 ft. Date 3/15/74

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-37

DATE 3/14/74 SURFACE ELEV. 93.6 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0								
		4	Fill: Loose brown to black silty fine to medium sand with 20% paper, metal and glass					
5		5		86.1				
		3						
10		3	Fill: Very loose to loose black organic silt with 35% to 95% paper, glass and plastic					
15		5						
20		11		71.1				
		16						
25			Fill: Medium dense gray silty fine to medium sand, trace fine gravel with 25% to 60% paper, glass, metal, rubber and wood					
30		12						
35		21		56.6				
			Dense gray medium to coarse sand and gravel	53.8				
40		48						
			Stiff to very stiff brown and gray clayey silt with fine to medium to coarse sand lenses					
45		55						

COMPLETION DEPTH 60.5 ft. Water Depth 44.5 ft. Date 3/14/74

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-36 Continued

DATE 3/12/74 SURFACE ELEV. 86.0 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45								
		63	Very dense gray silty fine sand, trace fine gravel with fine sand lenses	32.0				
50								
55		55	Very dense gray fine sandy silt with fine to medium sand lenses	30.5				
60								

Encountered water at 11' while drilling

Well point installed at elevation 30.5

Date	Water Depth	Water Elevation
3/13	48.7'	37.3
3/14	41.0'	45.0
3/15	35.4'	50.6
3/18	32.4'	53.6
3/19	35.0'	51.0
3/20	35.8'	50.2
3/22	32.1'	53.9
5/13	30.8'	55.2
8/ 6	(Clogged)	

COMPLETION DEPTH 55.5 ft. Water Depth 41.5 ft. Date 3/13/74

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-38

DATE 3/5-7/74 SURFACE ELEV. 110.3 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		22	Dense dark brown medium sand and fine gravel	104.8				
5		14						
		16	Medium dense light brown fine to medium sand					
10		21						
15		19						
20		28		86.3				
25		30	Medium dense to very dense brown and gray silty fine sand					
30		62						
35		10						
40		17						
45		17						

COMPLETION DEPTH 80.5 ft. Water Depth 44.0 ft. Date 3/7/74

SAMPLER: 3" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-37 Continued

DATE 3/14/74 SURFACE ELEV. 93.6 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45		57	Stiff to very stiff brown and gray clayey silt with fine to medium to coarse sand lenses	41.1				
50								
55		47	Dense gray and brown silty fine sand with clayey silt lenses	33.1				
60		46						
65			Encountered water at 2.5' while drilling					

Date	Water Depth	Water Elevation
3/15	10.1'	83.5
3/18	9.7'	83.9
3/19	10.0'	83.6
3/20	10.5'	83.1
3/22	9.9'	83.7
5/13	10.2'	83.4

COMPLETION DEPTH 60.5 ft. Water Depth 44.5 ft Date 3/14/74

SAMPLER: 3" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. b-39

DATE 3/8/74 SURFACE ELEV. 114.9 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		18	Medium dense light brown and light gray fine to medium sand and gravel					
5		22						
		21						
10		30						
		28						
15								
		32						
20				90.9				
		53	Very dense to medium dense brown and gray silty fine sand					
25								
		66						
30								
		24						
35								
		16						
40								
		24						
45								

COMPLETION DEPTH 85.5 ft. Water Depth 49' Date 3/8/74

SAMPLER: 3" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-38 Continued

DATE 3/5-7/74 SURFACE ELEV. 110.3 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45								
		59	Medium dense to very dense brown and gray silty fine sand					
50								
		56						
55				51.3				
		39						
60			Dense to very dense gray medium to coarse becoming fine to coarse sand					
65		43						
70		51						
75		61						
80				29.8				
		84	Encountered water at 30' while drilling					
85			Date / Water Depth: 3/13 25.7'; 3/14 25.5'; 3/15 24.7'; 3/18 24.0'; 3/19 25.6'; 3/20 25.5; 3/22 25.5'					

COMPLETION DEPTH 80.5 ft. Water Depth 44.0 ft. Date 3/7/74

SAMPLER: 3" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-40

DATE 3/8-12/74 SURFACE ELEV. 115.5 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		18	Medium dense light brown and gray fine to medium sand					
5		9						
10		11						
		11		101.5				
15		15	Medium dense light brown and gray silty fine to medium sand					
20		20						
25		23						
30		23						
				80.5				
35		10	Loose brown silty fine sand with silty clay lenses					
40		7						
45		5						

COMPLETION DEPTH 80.5 ft Water Depth 37.9 ft. Date 3/12/74

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-39 Continued

DATE 3/8/74 SURFACE ELEV. 114.9 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45			Very dense to medium dense brown and gray silty fine sand					
50		33		63.9				
55		32	Very stiff dark gray clayey silt with fine sand lenses past 65'					
60		17						
65		30						
70		18						
75		21						
				34.9				
80		24	Medium dense dark gray silty fine sand with medium sand lenses					
85		28		29.4				
90			Encountered water at 35', while drilling					

Date	Water Depth	Date	Water Depth
3/13	17.5'	3/19	13.1'
3/14	17.5'	3/20	13.2'
3/18	13.2	3/22	13.2'

COMPLETION DEPTH 85.5 ft. Water Depth 49' Date 3/8/74

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-41

DATE 3/15/74 SURFACE ELEV. 33.6 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		6	Loose yellow-brown fine sandy silt	29.6	22.0			
5		21	Medium dense gray fine to medium sandy silt with rock fragments	26.6	5.2			
10		23	Very stiff to stiff brown and gray silty clay, traces of mica past 11' with lenses of fine to medium sand.		36.6			
		12		20.1	39.3	39	16	
15		13	Medium dense dark grey medium sand.	14.6	19.7			
20		66	Very dense grayish green fine sandy silt.	11.6				
25		40	Medium dense grayish green clayey silt with fine sand lenses.	2.1				
30		24						
35			Encountered water at 4' while drilling Installed well point at elevation 2.1					

Date	Water Depth	Water Elevation
3/18	13.5'	20.1
3/19	12.6'	21.0
3/20	11.0'	22.6
3/22	10.1'	23.5
5/13	3.8'	29.8
8/ 6	6.2'	27.4

COMPLETION DEPTH 31.5 ft. Water Depth 3.8 ft. Date 3/15/74

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-40 Continued

DATE 3/8-12/74 SURFACE ELEV. 115.5 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45			Loose brown silty fine sand with silty clay lenses	66.5				
50		14	Medium dense to dense dark gray fine sand, trace clay with lenses of loose sand					
55		12						
60		34						
65		34						
70		31		45.5				
75		26	Very stiff dark gray silty clay					
80		26		35.0				
85			Encountered water at 35' while drilling					

Date	Water Depth	Water Elevation
3/13	66.5'	49.0
3/14	57.2'	58.3
3/15	44.8'	70.7
3/18	41.0'	74.5
3/19	41.2'	74.3
3/30	41.1'	74.4
3/22	41.0'	74.5
8/6	(Caved in)	

COMPLETION DEPTH 80.5 ft. Water Depth 37.9 ft. Date 3/12/74

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-43

DATE 3/15/74 SURFACE ELEV. 20.4 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Brown humus	20.2				
		30						
5		65	Medium dense to dense greenish grey fine sandy silt with fine sand lenses.					
		17						
10		19		7.4				
		18	Very stiff gray silty clay, trace fine sand.					
20		20		-0.1				
			Encountered water at 9.5' while drilling					
25								

Date	Water Depth	Water Elevation
3/18	1.0'	19.4
3/19	1.0'	19.4
3/20	1.0'	19.4
3/22	1.0'	19.4

COMPLETION DEPTH 20.5 ft. Water Depth 11.5 ft. Date 3/15/74

SAMPLER 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-42

DATE 3/15/74 SURFACE ELEV. 37.7 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Brown humus	37.6				
		5	Soft brown and grey clayey silt, trace fine sand.	32.2	30.4	34	28	
5		11	Stiff brown and grey silty clay with 1/16" limonite lenses.	30.7	51.0			
		9	Stiff brown and grey silty clay with fine sand lenses.	26.2	40.8			
10		16	Medium dense yellow silty fine to medium sand, trace gravel.	24.7	22.3			
15		14	Medium dense dark grey medium to coarse sand with lenses of clayey silt.		16.6			
20		21		17.2	18.1			
			Encountered water at 11.5' while drilling					
25								

Date	Water Depth	Water Elevation
3/18	1.0'	36.7
3/19	1.0'	36.7
3/20	1.0'	36.7
3/22	0.7'	37.0

COMPLETION DEPTH 20.5 ft. Water Depth 6.2 ft. Date 3/15/74

SAMPLER 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-45

DATE 3/15/74 SURFACE ELEV. 27.2 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Brown humus	27.1				
5		9	Loose to medium dense yellow medium to coarse sand and gravel.		18.9			M
		11		19.7	19.8			
10		10	Stiff to very stiff greenish gray silty clay, some fine sand.		38.7			
		13			38.8			
15		26						
20		25		6.7				
25			Encountered water at 1.5' while drilling					

Date	Water Depth	Water Elevation
3/18	0.4'	26.8
3/19	0.4'	26.8
3/20	0.4'	26.8
3/22	0.1'	27.1

COMPLETION DEPTH 20.5 ft. Water Depth 0.7 ft. Date 3/15/74

SAMPLER: 2" O D SPLIT BARREL SAMPLER

LOG of BORING No. B-44

DATE 3/18/74 SURFACE ELEV. 27.7 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		5	Loose brown medium to coarse sandy silt.	23.7	11.7			M
5		14	Medium dense orange and gray to black silty medium to coarse sand with silty clay lenses to 7'.		19.3			
		32		17.7	15.7			
10		29	Very stiff gray silty clay with lenses of fine sand.	14.7	35.5			
15		32	Dense greenish gray fine sandy silt.					
20		34		7.2				
25			Encountered water at 2.5' while drilling					

Date	Water Depth	Water Elevation
3/19	2.2'	25.5
3/20	2.2'	25.5
3/22	1.3'	26.4

COMPLETION DEPTH 20.5 ft. Water Depth 2.5 ft. Date 3/18/74

SAMPLER: 2" O D SPLIT BARREL SAMPLER

LOG of BORING No B-47

DATE 3/18/74 SURFACE ELEV. 19.4 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0								
		8	Firm yellowish-brown clayey silt	15.4				
5		23	Medium dense greenish-gray fine sandy silt	12.4				
		16	Very stiff brown and gray silty clay with fine sand lenses	9.4				
10		15	Stiff to hard greenish-gray clayey silt, traces fine sand					
15		19						
20		33		- 2.1				
25			Encountered water at 10.5' while drilling					

Date	Water Depth	Water Elevation
3/19	1.1'	18.3
3/22	0.2'	19.2

COMPLETION DEPTH 21.5 ft. Water Depth 10.5 ft. Date 3/18/74

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-48

DATE 3/15/74 SURFACE ELEV. 28.3 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Yellow brown fine sandy silt	27.3				
		5	Loose yellow and gray medium to coarse sand and gravel with clayey silt lenses	24.3				
5		21						
		21	Medium dense brown and gray clayey silt with fine sand lenses and trace mica					
10		16		14.3				
15		19	Medium dense green-gray clayey silt with fine sand lenses					
20		28		6.8				
25			Encountered water at 1.5' while drilling					

Date	Water Depth	Water Elevation
3/18	0.7'	27.6
3/19	1.1'	27.2
3/20	1.1'	27.2
3/22	1.0'	27.3

COMPLETION DEPTH 21.5 ft. Water Depth 2.1 ft. Date 3/15/74

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-49

DATE 3/18/74 SURFACE ELEV. 26.1 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		7	Firm yellow-brown medium to coarse sandy clay with medium to coarse sand lenses	22.1				
5		11	Medium dense dark gray fine sandy silt, traces of mica with medium to coarse sand lenses	18.6				
		7	Firm dark gray clayey silt, traces of mica	15.6				
10		8	Loose dark gray silty medium to coarse sand	13.1				
15		19	Very hard greenish gray silty clay with fine sand lenses	5.6				
20		17						
			Encountered water at 2.5' while drilling					
25								

Date	Water Depth	Water Elevation
3/19	0.4'	25.7
3/22	0.2'	25.9

COMPLETION DEPTH 20.5 ft. Water Depth 2.0 ft. Date 3/18/74

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-48

DATE 3/21/74 SURFACE ELEV. 22.7 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Topsoil	22.4				
		5			14.2			M
5		9	Loose yellow to gray silty medium to coarse sand	15.7	19.4			
		19			48.7			
10		20	Very stiff green silty clay, traces of fine sand with sand content increasing with depth		44.1			
15		23		4.7				
		70	Very dense green and black fine sandy silt	2.2				
20			Encountered water at 3' while drilling					
25								

COMPLETION DEPTH 20.5 ft. Water Depth 3.0 ft. Date 3/21/74

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-51

DATE 10/1/74 SURFACE ELEV. 27.0 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Topsoil	26.3				
5		20	Medium dense gray silty fine to coarse sand.	20.0				
10		19						
		9	Loose dark gray sandy silt.	17.0				
15		22						
		53						
20		29	Stiff green clayey sandy silt to silty clay.					
25		30						
30		25		-4.5				
35			Encountered water at 1.5' while drilling. Wellpoint with riser pipe installed at 20.0' Impervious seal installed at 12.0'. Water observation pipe set at 10.0'.					

Date	Water Depths Wellpoint	Pipe
10/1	11.2'	0.0'
10/2	10.9'	1.1'
10/4	10.8'	1.3'
10/8	10.9'	1.0'
10/10	10.9'	1.0'

COMPLETION DEPTH 31.5' Water Depth 1.1' - P Date 10/24/74
11.6' - W. P. 10/24/74
SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-50

DATE 3/18/74 SURFACE ELEV. 44.8 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0		3	Fill: Loose yellowish brown silty fine to medium sand with root fragments., 45% wood and paper					
5		2		37.8				
		3	Fill: Soft yellow brown organic clayey silt with 15% glass and paper	34.3				
10		8	Fill: Loose white silty medium to coarse sand with 15% glass, metal and paper	31.8				
15		24	Very stiff brown and gray clayey silt with sand or clayey sand lenses					
20		18		24.3				
25		21	Medium dense brown clayey medium to coarse sand					
30		15		14.3				
35			Encountered water @ 7' while drilling					

Date	Water Depth	Water Elevation
3/18	2.4'	42.4
3/19	2.4'	42.4
3/22	2.4'	42.4

COMPLETION DEPTH 30.5 ft. Water Depth 2.5 ft. Date 3/18/74
SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-53

DATE 9/30/74 SURFACE ELEV. 33.5 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Topsoil	33.2				
		5	Loose brown and gray silty fine to medium sand.	29.0				
5		15						
		17	Gray interbedded firm to stiff silty sand.					
10		16						
15		12		16.0				
20		22						
			Stiff green clayey sandy silt.					
25		16						
30		26						
35		44		- 3.0				
40			Encountered water @ 10.2' while drilling. Wellpoint with riser pipe set at 20.0'. Impervious seal installed at 12.0'. Water observation pipe set at 10.0'.					

Date	Water Depths Wellpoint	Pipe
10/7	10.3	-
10/10	10.5	-

COMPLETION DEPTH 36.5' Water Depth 9.6' - Pipe Date 10/24/74
10.8' - W. P. 10/24/74

SAMPLER: 3" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-52

DATE 9/27/74 SURFACE ELEV. 28.7 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Topsoil	28.2				
		14	Medium dense brown silty fine to coarse sand.	24.7				
5		7	Loose to medium dense tan silty gravelly sand.					
		14		19.2				
10		11						
15		22						
20		20	Stiff green clayey silt.					
25		19						
30		20						
35		22		-7.8				
40			Encountered water at 5.0' while drilling. Wellpont with riser pipe set at 20.0'. Impervious seal installed at 11.0'. Water observation pipe set at 10.0'.					

Date	Water Depths Wellpoint	Pipe
10/7	6.4'	5.1'
10/10	6.4'	5.2'
10/24	7.3'	5.9'

COMPLETION DEPTH 36.5' Water Depth 6.3' - W.P. Date 10/4/74
5.2' - pipe 10/4/74

SAMPLER: 3" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-54 (Cont.)

DATE 9/30/74 SURFACE ELEV. 43.7 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45		24		-2.8				
50			Encountered water at 5.0' while drilling Well-point with riser pipe installed at 30.0' Impervious seal installed at 22.0' Water observation pipe set at 20.0'					

Water Depths

Date	Well-point	Pipe
9/30	9.8'	12.8'
10/02	8.2'	9.2'
10/03	8.3'	9.2'
10/04	8.2'	9.5'
10/07	8.2'	9.5'
10/08	8.3'	9.4'
10/09	8.2'	9.3'
10/10	8.2'	9.2'
10/24	8.8'	9.7'

COMPLETION DEPTH 46.5' Water Depth ____ Date ____

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-54

DATE 9/30/74 SURFACE ELEV. 43.7 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Topsoil	43.4				
5		4 5	Loose brown medium to fine sandy silt, trace clay	36.7				
10		10 4						
15		15	Tan and gray interbedded stiff sandy silty clay and medium dense gray brown coarse to fine sand and sandy silt					
20		70/4"		23.2				
25		24						
30		21	Very stiff greenish gray coarse to fine sandy clay grading into clayey silt to silt, trace clay					
35		24						
40		26						
45		24		-2.8				

COMPLETION DEPTH 46.5 Water Depth ____ Date ____

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-55 (Cont.)

DATE 10/8-9/74 SURFACE ELEV. 78.2 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45				32.2				
50		12	Very stiff brown clayey silt with thin sand lenses					
55		30						
		20		21.2				
60		34	Very stiff to hard green silt, sandy clay becoming clayey silt with depth					
65		28						
70		25						
75		55		1.7				
80			Encountered water @ 20' while drilling Well-point with riser pipe set at 65.0' Impervious seal installed at 50.0'					

Water Depths

Date	Wellpoint	Pipe
10/ 9		42.5'
10/10		46.9'
10/24	39.8'	16.5'

COMPLETION DEPTH 76.5 Water Depth ____ Date ____

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-55

DATE 10/8-10/74 SURFACE ELEV. 78.2 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0								
5		8	Fill - Loose to medium dense sand and trash.					
10								
15		11						
20		7		54.2				
25		10	Interbedded stiff brown clay and dense gray medium to fine sand becoming very stiff brown clayey silt with thin sand layers					
30		34						
35		31						
40		29		35.2				
45		12	Medium dense gray gravelly coarse to fine sand, trace silt	32.2				

COMPLETION DEPTH 76.5 Water Depth ____ Date ____

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

LOG of BORING No. B-56 (Cont.)

DATE 10/7/74 SURFACE ELEV. 91.1 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45		32	Very stiff to hard gray clayey silt with thin layers of gray fine sand					
50		33						
55		26		35.1				
60		38	Interbedded gray hard clayey silt, medium dense gray gravelly coarse to fine sand and dense green medium to fine sandy silt					
65		21						
70		37		19.6				
75			Encountered water at 27.5' while drilling Water at 64.5' at completion Well-point with riser pipe set at 63.5' Impervious seal installed at 42.0 Water observation pipe set at 32.0'					

Date	Water Depths Well-point	Pipe
10/07	51.8'	32.2
10/09	51.4'	26.8'
10/10	55.1'	26.8'
10/24	50.6'	27.3'

COMPLETION DEPTH 71.5 Water Depth ____ Date ____

SAMPLER 2" O.D. SPLIT BARREL SAMPLER

LOG of BORING No. B-56

DATE 10/7/74 SURFACE ELEV. 91.1 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0								
5								
10		27	Fill -					
15		8	Loose to medium dense brown sand and trash					
20		100/1.5"						
25		100/3"		62.6				
30		11	Medium dense interbedded gray coarse to fine sand, gray silt with some laminations and tan clayey coarse to fine sand					
35		21		53.1				
40		27	Very stiff to hard gray clayey silt with thin layers of gray fine sand					
45		32						

COMPLETION DEPTH 71.5 Water Depth ____ Date ____

SAMPLER 2" O.D. SPLIT BARREL SAMPLER

JOB # 73P77

LOG of BORING No. B-57 (Cont.)

DATE 10/1-3/74 SURFACE ELEV. 93.4 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45		46	Dense interbedded gray silt and medium to fine sand					
50		35						
55		25		37.7				
60		24	Interbedded very stiff gray silty clay and medium dense gray coarse to fine sand, trace silt					
65		25		26.4				
70		49	Dense green medium to fine sandy silt and green silt becoming hard green silty clay with thin fine sand lenses					
75		30						
80		34		11.9				
85			Encountered water at 17.5' while drilling Encountered second water level between 40-45' Well point with riser pipe set at 73.5' Impervious seal installed at 52.0'					

Water Depth

Date	Wellpoint	Pipe
10/07	52.3'	34.7'
10/10	52.1'	34.5'

COMPLETION DEPTH 81.5' Water Depth 34.0' - Pipe Date 10/24/74
SAMPLER 3" O.D. SPLIT BARREL SAMPLER 51.0' - W. P. 10/24/74

LOG of BORING No. B-57

DATE 10/1-3/74 SURFACE ELEV. 93.4 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0								
5								
10		114	Fill - Brown sand and trash					
15								
20				72.9				
22		34	Medium dense to dense tan and gray coarse to fine sand, trace silt, grading into silt laminated with sandy silt					
25								
30		17						
35		28		55.4				
40		41	Dense interbedded gray silt and medium to fine sand					
45								

COMPLETION DEPTH 81.5 Water Depth ____ Date ____
SAMPLER 3" O.D. SPLIT BARREL SAMPLER

Job No. 73P77

A-42

000363

LOG of BORING No. B-58 (Cont.)

DATE 10/7-8/74 SURFACE ELEV. 95.4 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45		37	Very stiff to hard gray clayey silt laminated with brown fine sand, silt and coarse to fine sand					
50		35						
55		29						
60		45						
65		40						
70		19		22.9				
75		30	Hard green clayey silt, trace medium to fine sand					
80		40		13.9				
85			Encountered water at 27.5' while drilling Well-point with riser pipe installed at 70.0' Impervious seal installed at 52.0' Water observation pipe set at 46.5'					

Water Depths

Date	Wellpoint	Pipe
10/ 9	52.8'	
10/10		25.3'

COMPLETION DEPTH 81.5' Water Depth ____ Date ____

SAMPLER: 2" O.D SPLIT BARREL SAMPLER

NOTE: Offset boring drilled to 70.0' for water level observations

LOG of BORING No. B-58

DATE 10/7-8/74 SURFACE ELEV. 95.4 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Fill - Brown sand and trash	76.9				
5								
10		5						
15		11						
20		9	Loose to medium dense tan and gray coarse to fine gravelly coarse to fine sand, trace silt					
25		25						
30		30						
35		6		58.4				
40		24	Very stiff to hard gray clayey silt laminated with brown fine sand, silt, and coarse to fine sand					
45		37						

COMPLETION DEPTH 81.5 Water Depth ____ Date ____

SAMPLER 2" O.D SPLIT BARREL SAMPLER

APPENDIX

B

LABORATORY ANALYSIS

Laboratory tests were performed on representative samples of the subsurface materials to investigate the index and classification properties and the stratigraphical continuity of these materials. The results of these tests were used, together with the Standard Penetration Resistance and other field data, to aid in the analysis of the subsurface conditions.

Index and classification tests included determination of the natural moisture content of representative samples and the liquid and plastic limits of samples of fine grain soils. The organic content of refuse fill materials was determined by burning the oven dried samples in a crucible and then computed as a percentage of the overdried sample weight. The results of these index and classification tests are shown on the Summary of Laboratory Test Results, pages B-2 through B-13 and on the boring logs adjacent to the samples tested.

Mechanical analyses were performed to determine the grain size distribution of selected predominantly granular soil samples. The results of these tests are presented as grain size distribution curves on pages B-14 through B-20.

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH - feet	CLASSIFICATION	(1)	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT MOIST	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	$\overline{CIU}$	CELL PRESSURE (psi)	BACK PRESSURE (psi)
B-2 S- 1	2.0- 3.5			37.9														
S- 2	5.0- 6.5		30.69	69.6														
S- 3	8.0- 9.5			105.8														
S- 4	10.0-11.5		23.14	115.2														
S- 5	15.0-16.5			107.6														
S- 6	20.0-21.5		11.74	32.5														
S- 7	25.0-26.5			100.0														
S- 8	30.0-31.5		16.54	88.2														
B-4 S- 1	2.0- 3.5			46.3														
S- 2	5.0- 6.5		7.9	18.1														
S- 3	8.0- 9.5			33.9														
S- 4	10.5-12.0		16.2	53.2														

* See Test Curves

(1) Organic Content

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH - feet	CLASSIFICATION	(1)	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT MOIST	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	$\overline{CIU}$	CELL PRESSURE (psi)	BACK PRESSURE (psi)
B-4 S- 5	15.0-16.5		14.4	49.3														
S- 6	20.0-21.5			20.3														
S- 7	25.0-26.5			16.7														
S- 8	30.0-31.5			20.3														
B-6 S- 1	2.0- 3.5			20.2														
S- 2	5.0- 6.5		6.0	48.4														
S- 3	8.0- 9.5			57.9														
S- 4	10.5-12.0			69.2														
S- 5	15.0-16.5		17.16	56.2														
S- 6	20.0-21.5			95.2														
S- 7	25.0-26.5		7.2	32.2														
S- 8	30.0-31.5			82.5														
S- 9	35.0-36.5		4.6	22.8														
S-10	40.0-41.5			28.5														
S-11	45.0-46.5			28.9														

* See Test Curves

(1) Organic Content

0000369

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH - feet	CLASSIFICATION	(1)	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT MOIST	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	$\overline{CIU}$	CELL PRESSURE (psi)	BACK PRESSURE (psi)
B-9 S- 1	2.0- 3.5			105.2														
S- 2	5.0- 6.5		49.87	187.0														
S- 3	8.0- 9.5			45.8														
S- 4	10.5-12.0			101.3														
S- 5	15.0-16.5		28.29	134.3														
S- 6	20.0-21.5			149.9														
S- 7	25.0-26.5		13.19	48.5														
S- 8	30.0-31.5			50.9														
S- 9	35.0-36.5			41.6														
S-10	40.0-41.5			30.9														

* See Test Cur

(1) Organic Content

B-4

0600370

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMP No.	DEPTH - feet	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT MOIST	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	$\overline{CIU}$	CELL PRESSURE (psi)	BACK PRESSURE (psi)
B-13 S-12	49.0-51.5			22.7														
S-13	54.0-55.5			26.8														
S-14	59.0-61.5			37.3														
S-15	64.0-65.5			36.0														
B-15 S- 5	14.0-15.5			110.4														
S- 6	19.0-21.5			166.0														
S- 7	24.0-25.5	SW - SM		23.5							*							
S- 8	29.0-30.5			36.1														
S- 9	34.0-35.5			40.6														
S-10	39.0-40.5			36.7														
B-17 S-12	49.0-50.5	MH		43.3							*							
S-13	54.0-55.5	MH		46.6	64	47												
S-14	59.0-60.5	MH		18.6							*							
B-18 S-12	49.0-50.5			27.6														
S-13	54.0-55.5			25.6														

* See Test Cu

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH - feet	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT MOIST	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	$\overline{CIU}$	CELL PRESSURE (psi)	BACK PRESSURE (psi)
S-14	59.0-60.5			18.9														
B-19 S- 5	14.0-15.5	SM		14.5	61	32					*							
S- 6	19.0-20.5	SM - MH		44.0	56	48					*							
S- 7	24.0-25.5	MH		41.4	74	54												
S- 8	29.0-30.5	MH		37.2							*							
B-20 S- 1	2.0- 3.5			23.3														
S- 2	5.0- 6.5	ML		29.5	33	29												
S- 3	8.0- 9.5			32.6														
S- 4	11.0-12.5			37.6														
S- 5	14.0-15.5			32.3														
S- 6	19.0-20.5			36.7														
B-22 S- 5	14.0-15.5	MH		42.1	95	62												
S- 6	19.0-20.5			27.1														
S- 9	24.0-25.5	ML		19.8	NP	30												
S- 8	29.0-30.5			17.7														

* See Test Cv

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH - feet	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT MOIST	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	$\overline{CIU}$	CELL PRESSURE (psi)	BACK PRESSURE (psi)
B-23 S- 8	29.0-30.5			58.1														
S- 9	34.0-35.5	SM - ML		27.4							*							
S-10	39.0-40.5			32.6														
S-11	44.0-45.5			37.0														
B-24 S- 1	2.0- 3.5			22.5														
S- 2	5.0- 6.5			29.8														
S- 3	8.0- 9.5			30.6														
S- 4	11.0-12.5			27.2														
S- 5	14.0-15.5			34.5														
S- 6	19.0-20.5			35.0														
B-26 S- 8	29.0-30.5			40.5														
S- 9	34.0-35.5	ML		26.6							*							
S-10	39.0-40.5			19.8														
S-11	44.0-45.5			12.8														
B-27 S- 1	2.0- 3.5			31.5														

* See Test Curv

0600373

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH - feet	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT MOIST	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	$\overline{CIU}$	CELL PRESSURE (psi)	BACK PRESSURE (psi)
S- 2	5.0- 6.5			40.3														
S- 3	8.0- 9.5			31.9														
S- 4	11.0-12.5			33.4														
S- 5	14.0-15.5			24.7														
S- 6	19.0-20.5			38.3														
B-28 S- 3	8.0- 9.5	MH		40.7	89	50												
S- 4	11.0-12.5			35.6														
B-30 S- 1	2.0- 3.5			47.0														
S- 2	5.0- 6.5			22.2														
S- 3	8.0- 9.5			19.1														
S- 4	11.0-12.5			24.1														
B-31 S- 6	19.0-20.5			26.0														
S- 7	24.0-25.5			27.8														
S- 8	29.0-30.5			32.7														
S- 9	34.0-35.5			24.2														

* See Test Curv

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH - feet	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT MOIST	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	$\overline{CIU}$	CELL PRESSURE (psi)	BACK PRESSURE (psi)
B-32 S- 3	8.0- 9.5			37.6														
S- 4	11.0-12.5			33.2														
S- 5	14.0-15.5			32.8														
B-33 B- 7	24.0-25.5	SP - SM		16.5							*							
B- 8	30.0-31.5	SP - SM		14.1							*							
B-36 S- 1	2.0- 3.5			10.8														
S- 2	5.0- 6.5			17.1														
S- 3	8.0- 9.5			15.5														
S- 4	11.0-12.5			26.2														
S- 5	14.0-15.5			27.2														
S- 6	19.0-20.5			25.2														
S- 7	24.0-25.5			23.0														
S- 8	29.0-30.5			39.0														
S- 9	34.0-35.5			19.7														
S-10	39.0-40.5			24.4														

* See Test Curve

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH - feet	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT MOIST	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	$\overline{CIU}$	CELL PRESSURE (psi)	BACK PRESSURE (psi)
B-41 S- 1	2.0- 3.5			22.0														
S- 2	5.0- 6.5			5.2														
S- 3	8.0- 9.5			36.6														
S- 4	11.0-12.5	CL		39.3	39	16												
S- 5	15.0-16.5			19.7														
B-42 S- 1	2.0- 3.5	ML		30.4	34	28												
S- 2	5.0- 6.5			51.0														
S- 3	8.0- 9.5			40.8														
S- 4	11.0-12.5			22.3														
S- 5	14.0-15.5			16.6														
S- 6	19.0-20.5			18.1														
B-43 S- 1	2.0- 3.5	SM		28.7							*							
S- 2	5.0- 6.5			28.3														
S- 3	8.0- 9.5	SM		22.6							*							
S- 4	11.0-12.5			22.3														

* See Test Curves

9430030

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH - feet	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT MOIST	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	$\overline{CIU}$	CELL PRESSURE (psi)	BACK PRESSURE (psi)
B-43 S- 5	14.0-15.5	MH		32.0	80	49												
S- 6	19.0-20.5			34.1														
B-44 S- 1	2.0- 3.5	SM		11.7							*							
S- 2	5.0- 6.5			19.3														
S- 3	8.0- 9.5			15.7														
S- 4	11.0-12.5			35.5														
B-45 S- 1	2.0- 3.5	SP		18.9							*							
S- 2	5.0- 6.5			19.8														
S- 3	8.0- 9.5			38.7														
S- 4	11.0-12.5			38.8														
B-46 S- 1	2.0- 3.5			19.1														
S- 2	5.0- 6.5			42.4														
S- 3	8.0- 9.5	MH		42.2	83	53					*							
S- 4	11.0-12.5	MH		40.4							*							
S- 5	15.0-16.5	SM - MH		34.3	69	49					*							

* See Test Curv

0005277

SUMMARY OF LABORATORY TEST RESULTS

BORING and SAMPLE No.	DEPTH - feet	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT MOIST	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	$\overline{CIU}$	CELL PRESSURE (psi)	BACK PRESSURE (psi)
B-46 S- 6	20.0-21.5			29.2														
B-47 S- 1	2.0- 3.5	MH		58.8	90	51												
S- 2	5.0- 6.5	SM - MH		29.5							*							
S- 3	8.0- 9.5	MH		34.2	56	34												
B-48 S- 1	2.0- 3.5			14.2							*							
S- 2	3.0- 6.5			19.4														
S- 3	8.0- 9.5			48.7														
S- 4	11.0-12.5			44.1														
B-49 S- 1	2.0- 3.5			24.2														
S- 2	5.0- 6.5	MH		29.0							*							
S- 3	8.0- 9.5	ML - MH		44.3	47	27												
S- 4	11.0-12.5	SM		18.5							*							
S- 5	14.0-15.5	MH		38.4	80	40												
S- 6	19.0-20.5			40.2														
B-50 S- 5	14.0-15.5	MH		44.1	105	59					*							

* See Test Cv

SUMMARY OF LABORATORY TEST RESULTS

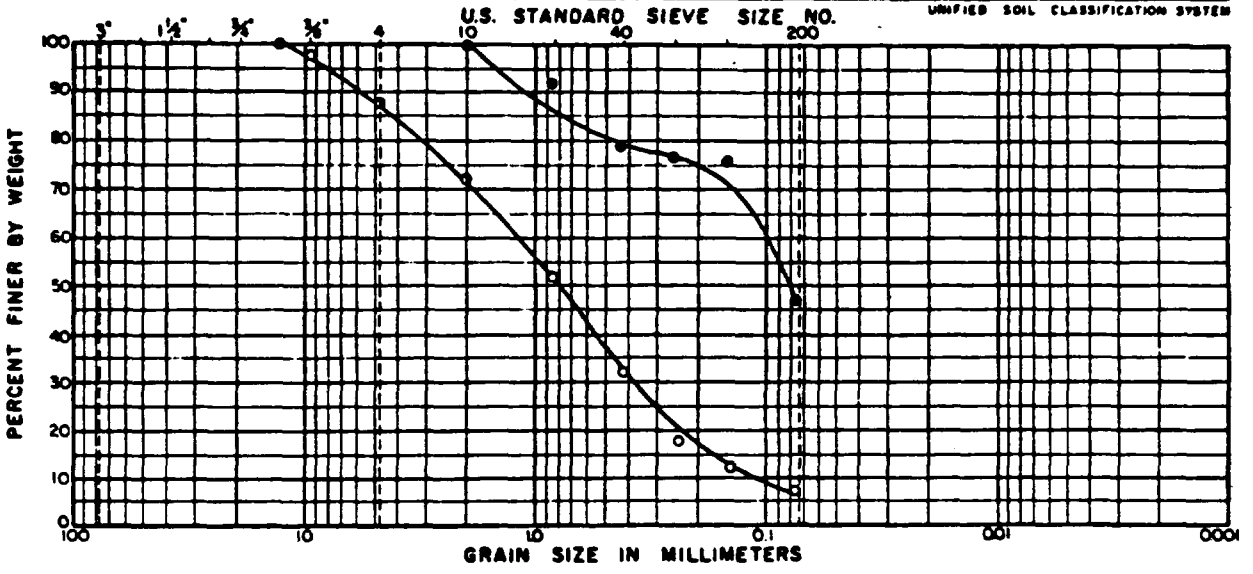
BORING and SAMPLE No.	DEPTH - feet	CLASSIFICATION	SPECIAL TESTS	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		UNCON. COMPRESS.		UNIT DRY WGT. (pcf)	SPECIFIC GRAVITY	GRAIN SIZE		OPT MOIST	CONSOLID.	TRIAXIAL			
					LIQUID LIMIT	PLASTIC LIMIT	STRESS (tsf)	STRAIN (%)			SIEVE	HYDR.			U.U.	$\overline{CIU}$	CELL PRESSURE (psi)	BACK PRESSURE (psi)
B-50 S- 6	19.0-20.5	SM		21.2	84	39					*							
S- 7	24.0-25.5	SM		21.6							*							
S- 8	29.0-30.5			17.7														
B-31 S-10	39.0-40.5			26.0														

* See Test Cur

649090

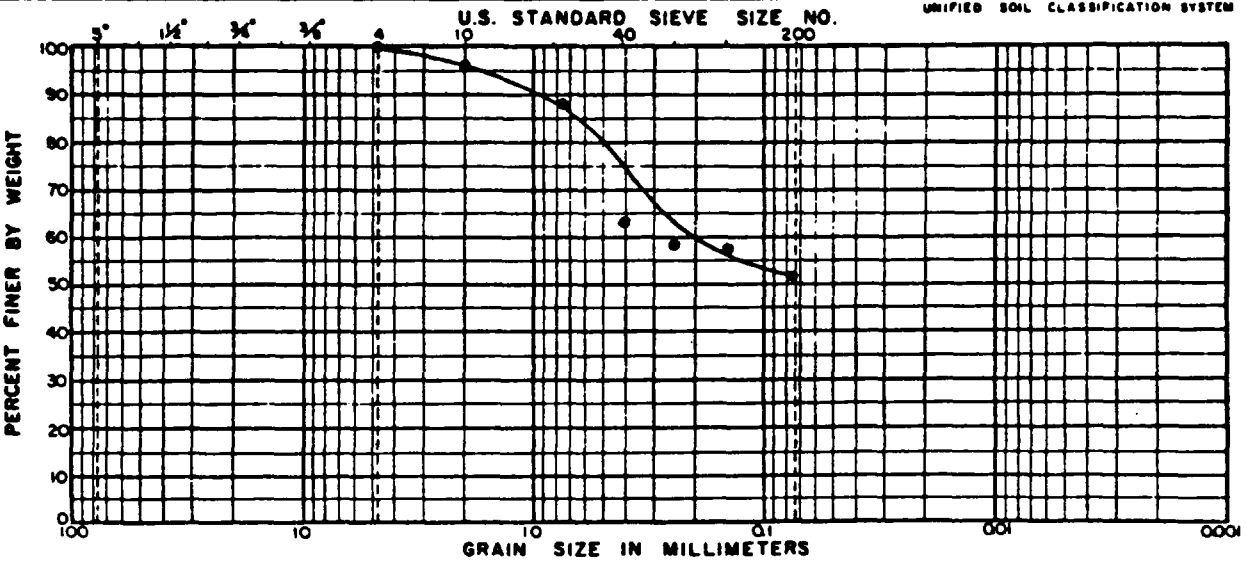
MECHANICAL ANALYSIS

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
B-15	S-7		○	Gray fine gravelly coarse to fine sand with trace of silt			
B-23	S-9	34'-35'6"	●	Light gray silty medium - fine sand			

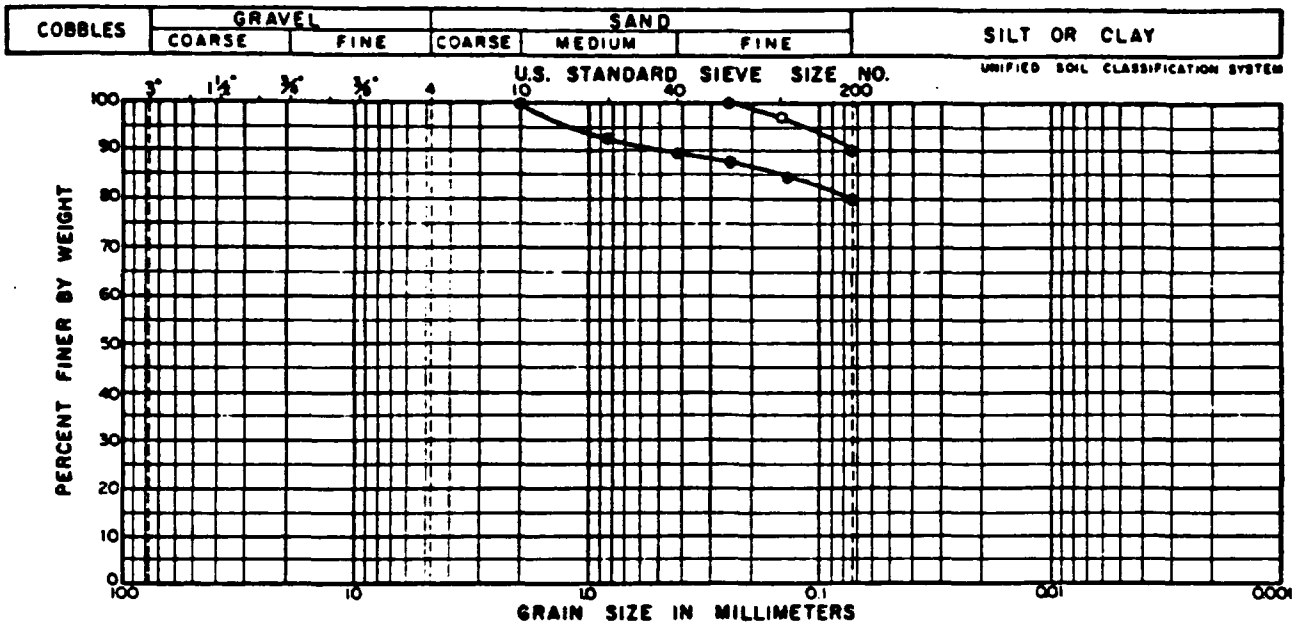
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



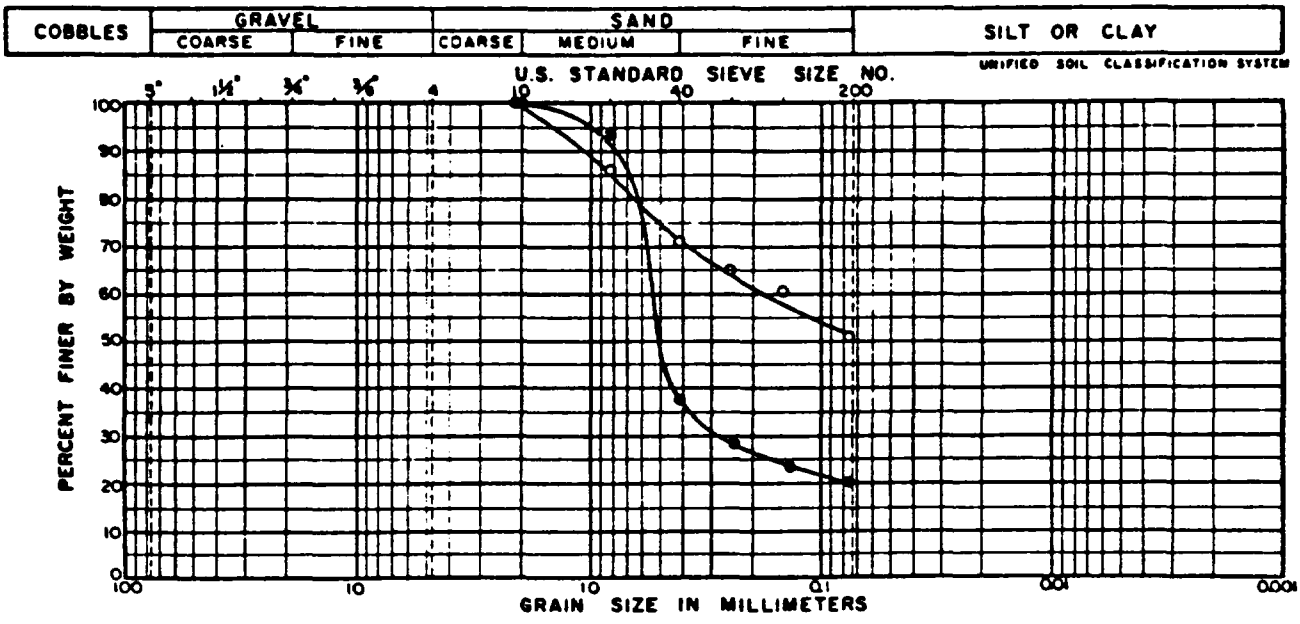
BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
B-26	S-9		●	Gray silty coarse to fine sand			

JOB NO.

MECHANICAL ANALYSIS



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
B-17	S-12	49.0-50.5	•	Dark gray micaceous medium to fine sandy silty clay.	43.3		
B-17	S-14	59.0-60.5	o	Dark gray micaceous fine sandy silty clay.	18.6		

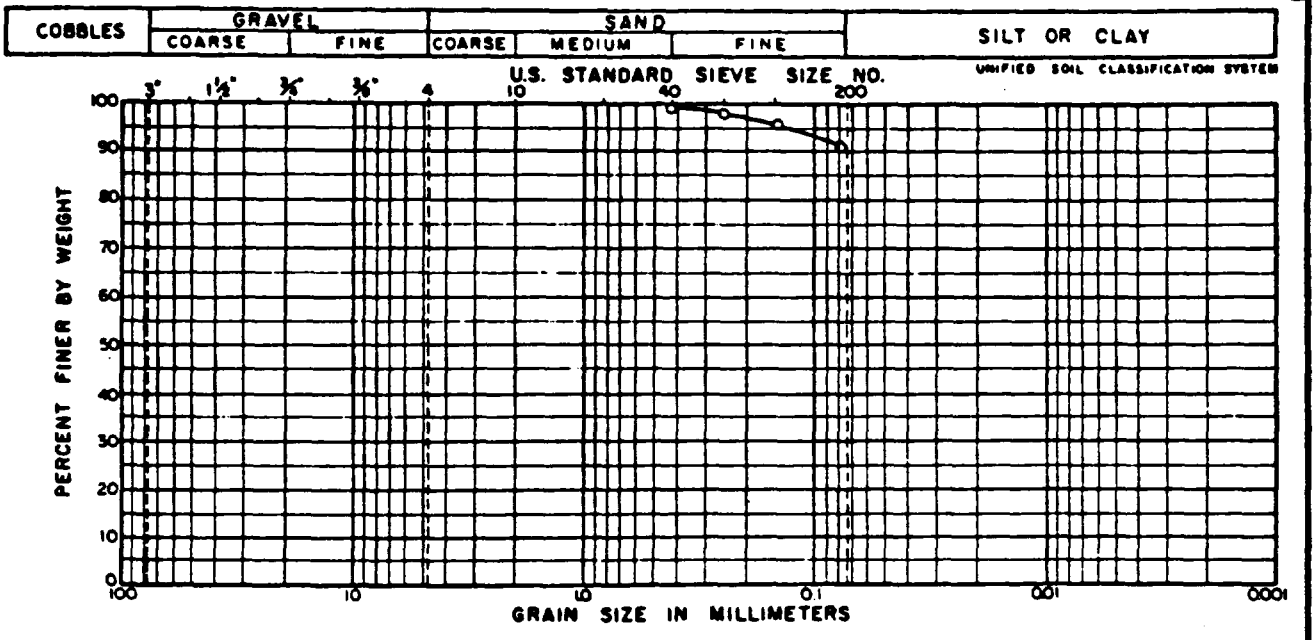


BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
B-19	S-5	14.0-15.5	•	Gray silty clayey medium to fine sand	14.5	61	32
B-19	S-6	19.0-20.5	o	Gray micaceous medium to fine sandy silty clay/clayey silt.	44.0	56	48

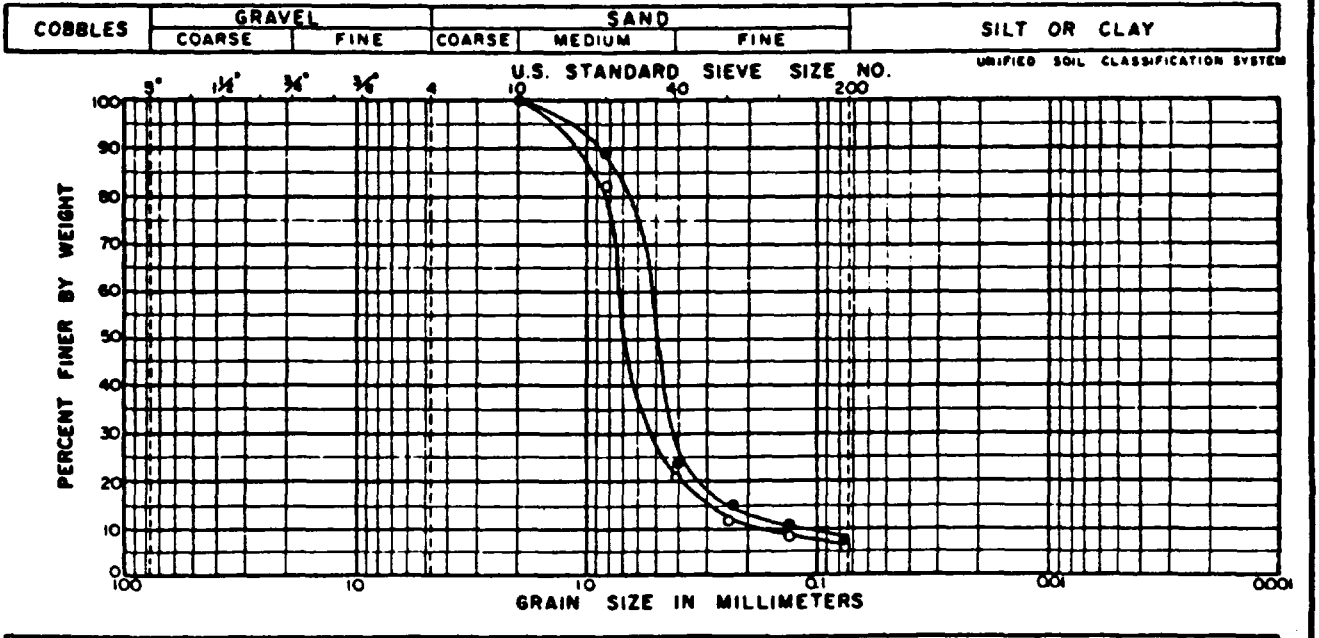
JOB NO. 13 P 71

T89090

MECHANICAL ANALYSIS



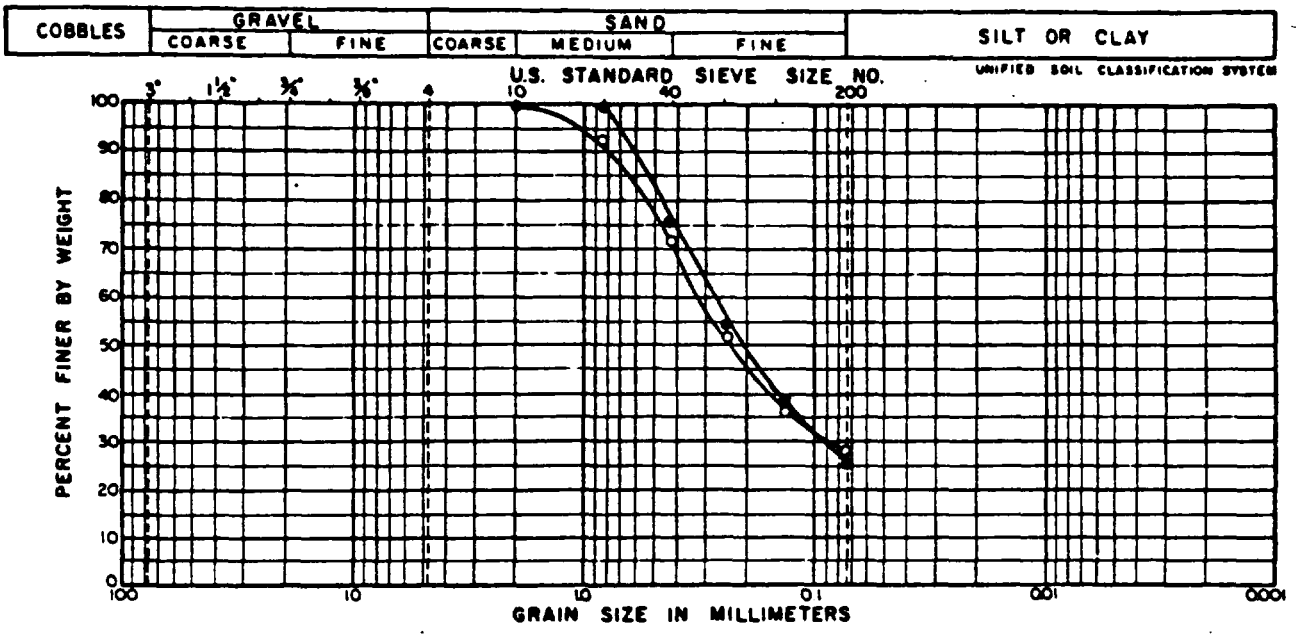
BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
B-19	S-8	29.0-30.5	○	Gray micaceous fine sandy silty clay.	37.2		



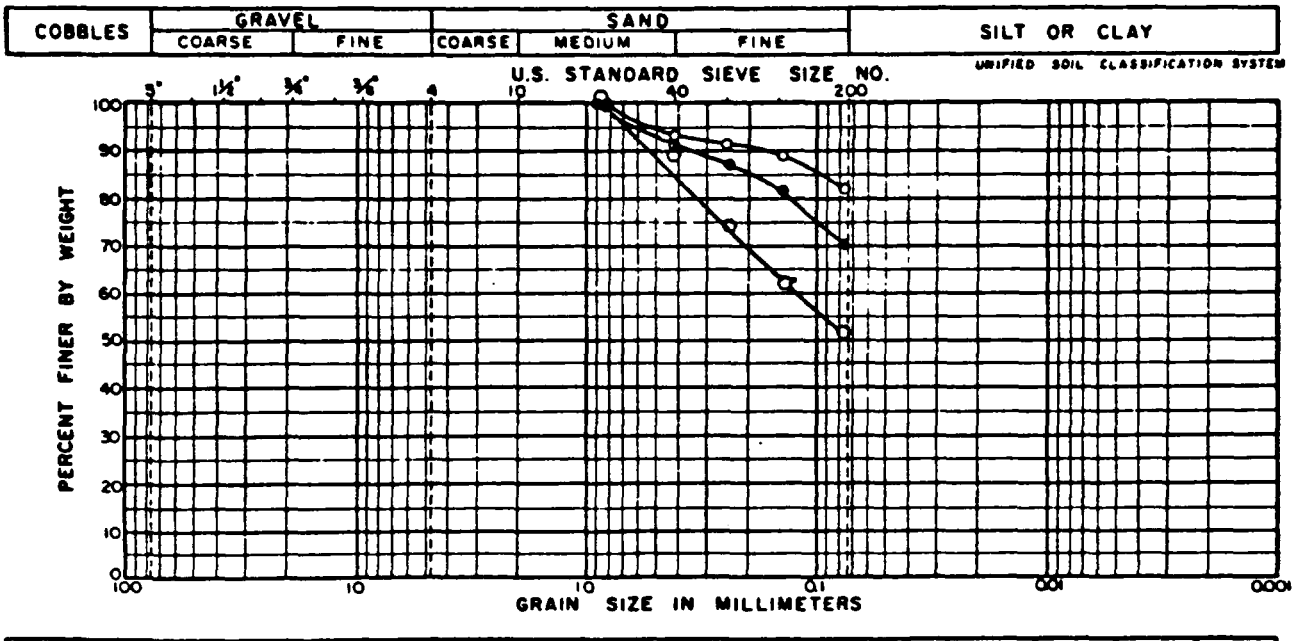
BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
B-33	S-7	24.0-25.5	○	Gray medium to fine sand, trace of silt.	16.5		
B-33	S-8	30.0-31.5	●	Tan medium to fine sand, trace of silt.	14.1		

JOB NO. 73 P 77

MECHANICAL ANALYSIS



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
B-43	S-1	2.0-3.5	○	Green tan silty clayey medium to fine sand.	28.7		
B-43	S-3	8.0-9.5	●	Green tan silty clayey medium to fine sand.	22.6		

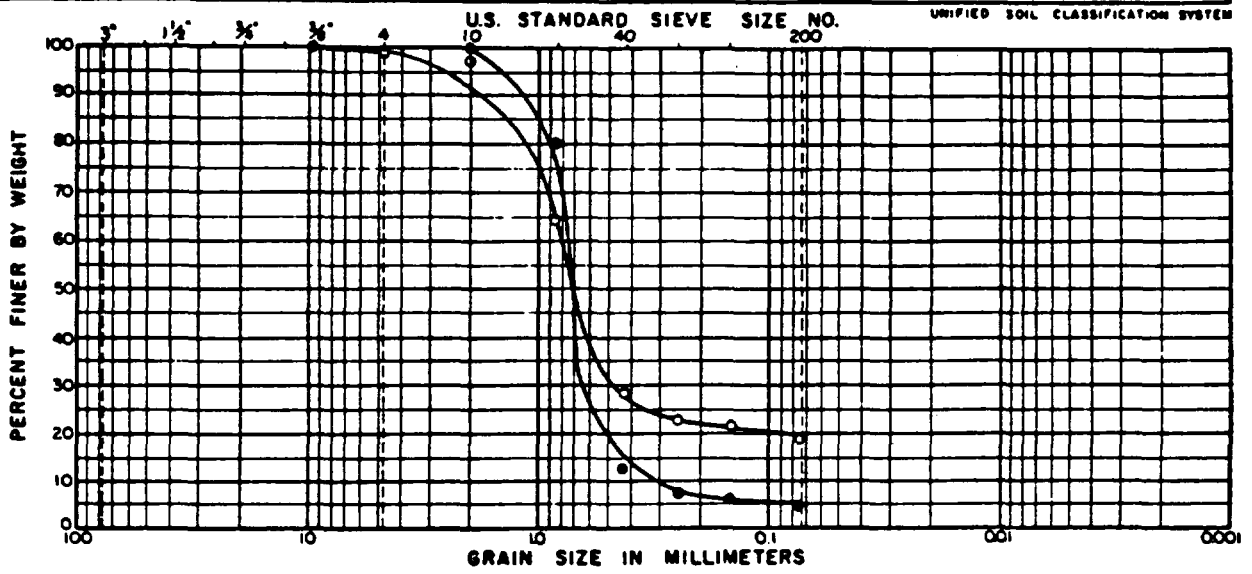


BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
B-46	S-3	8.0-9.5	○	Gray micaceous medium to fine sandy silty clay.	42.2	83	53
B-46	S-4	11.0-12.5	●	Dark gray micaceous medium to fine sandy silty clay.	40.4		
B-46	S-5	15.0-16.5	○	Green tan silty clayey medium to fine sand.	34.3	69	49

MECHANICAL ANALYSIS

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

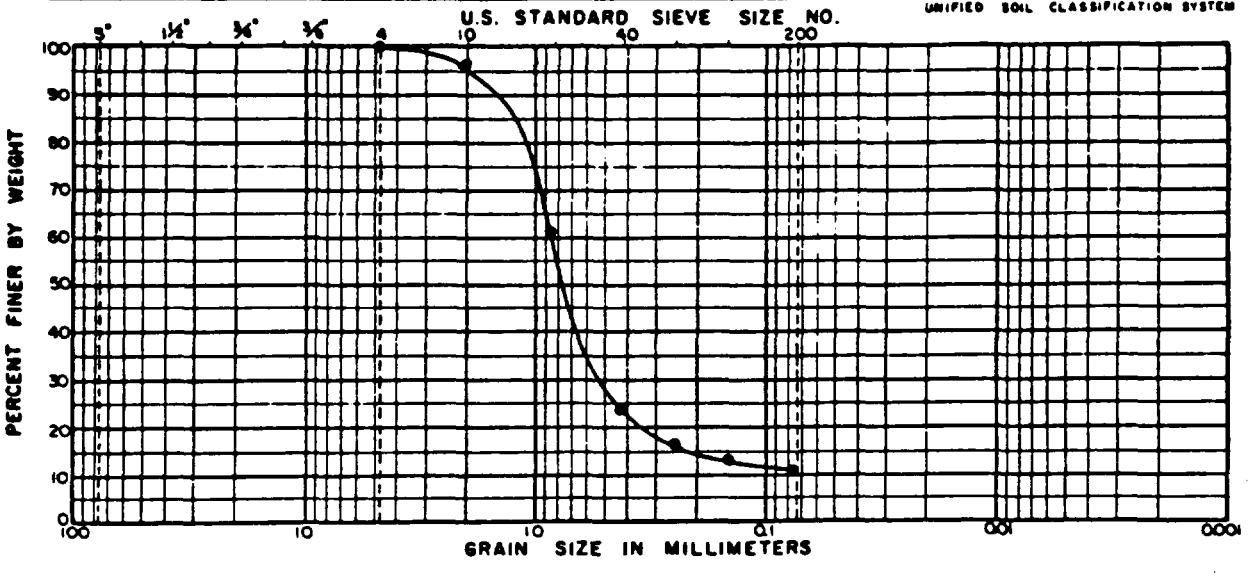
UNIFIED SOIL CLASSIFICATION SYSTEM



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
B-44	S-1	2'-3'6"	○	Tan silty coarse to fine sand			
B-45	S-1	2'-3'6"	●	Light brown medium to fine sand trace of silt			

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

UNIFIED SOIL CLASSIFICATION SYSTEM

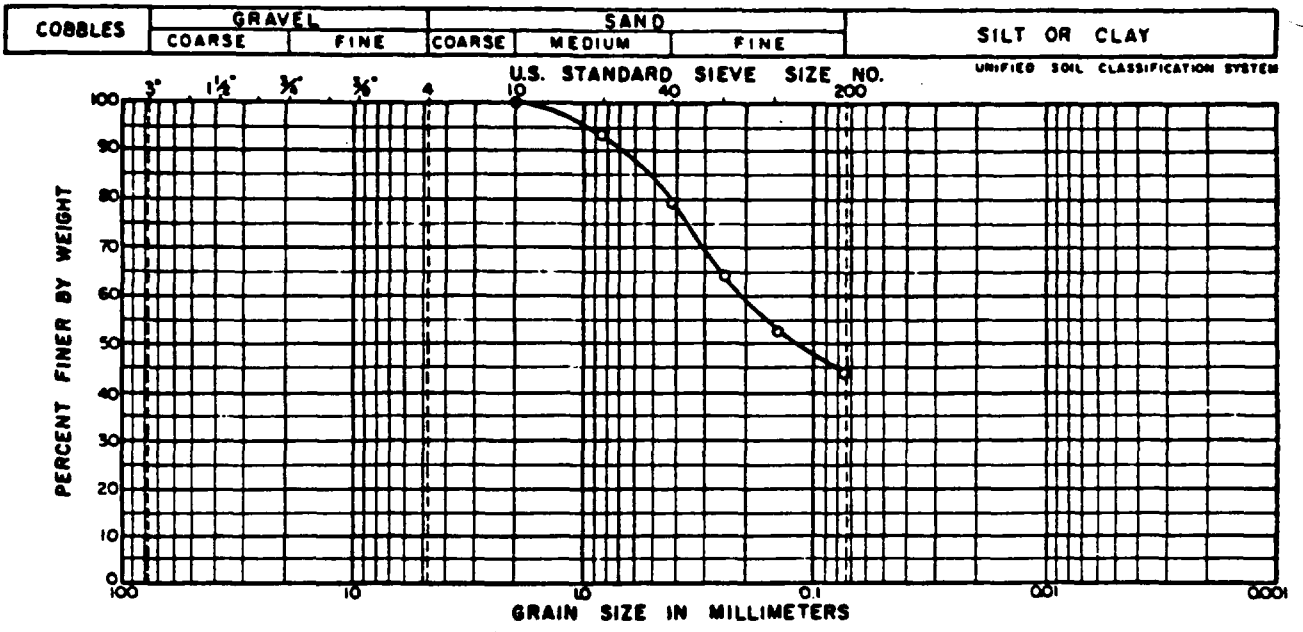


BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
B-48	S-1	2'-3'6"	●	Gray silty coarse to fine sand			

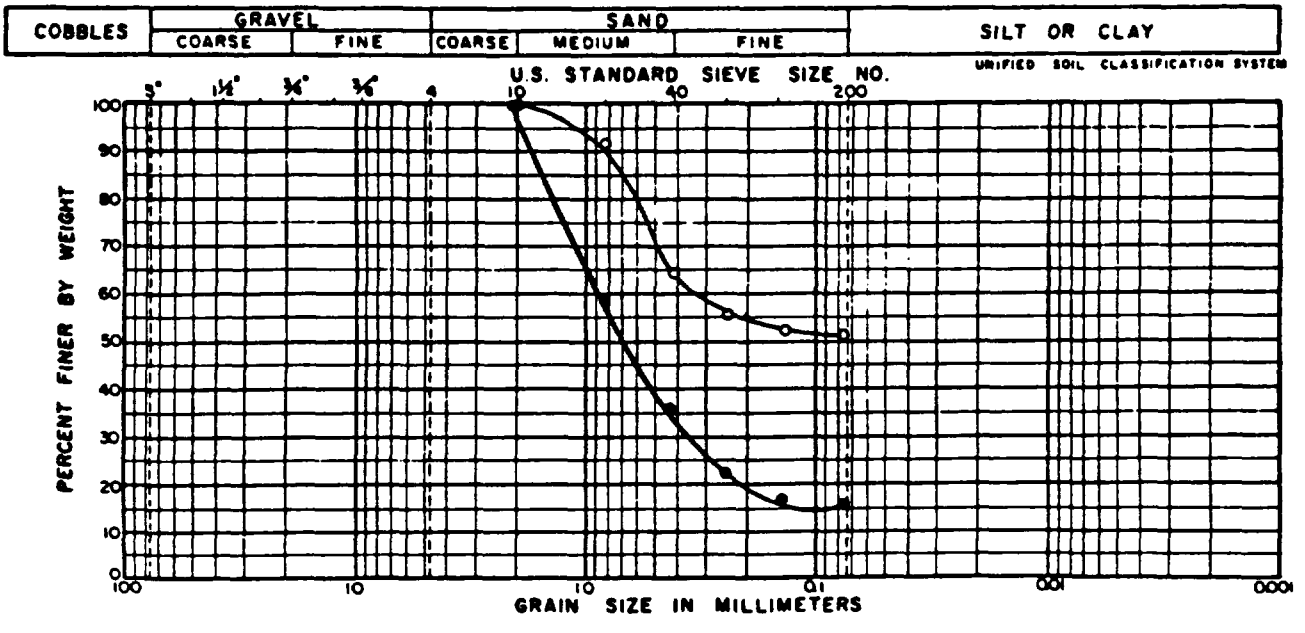
JOB NO. 13 P 11

RP-1

MECHANICAL ANALYSIS



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
B-47	S-2	5.0-6.5	○	Green-tan clayey medium to fine sand.	29.5		



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
B-49	S-2	5.0-6.5	○	Tan micaceous medium to fine sandy silty clay.	29.0		
B-49	S-4	11.0-12.5	●	Gray silty clayey medium to fine sand.	18.5		

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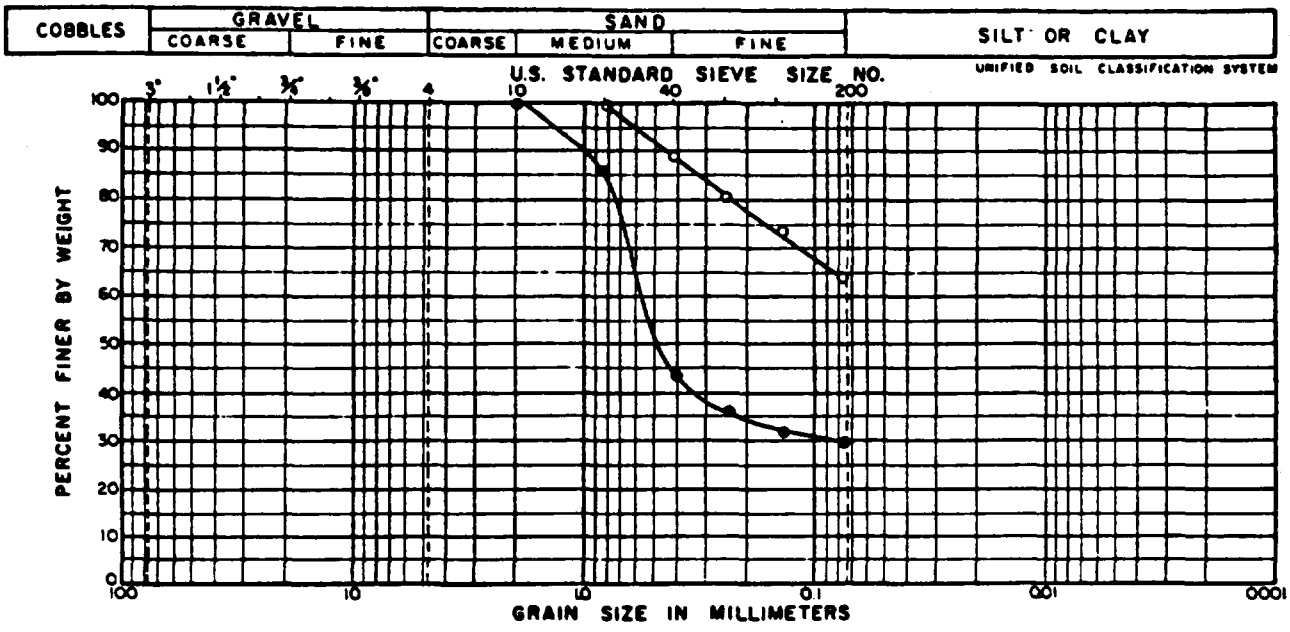
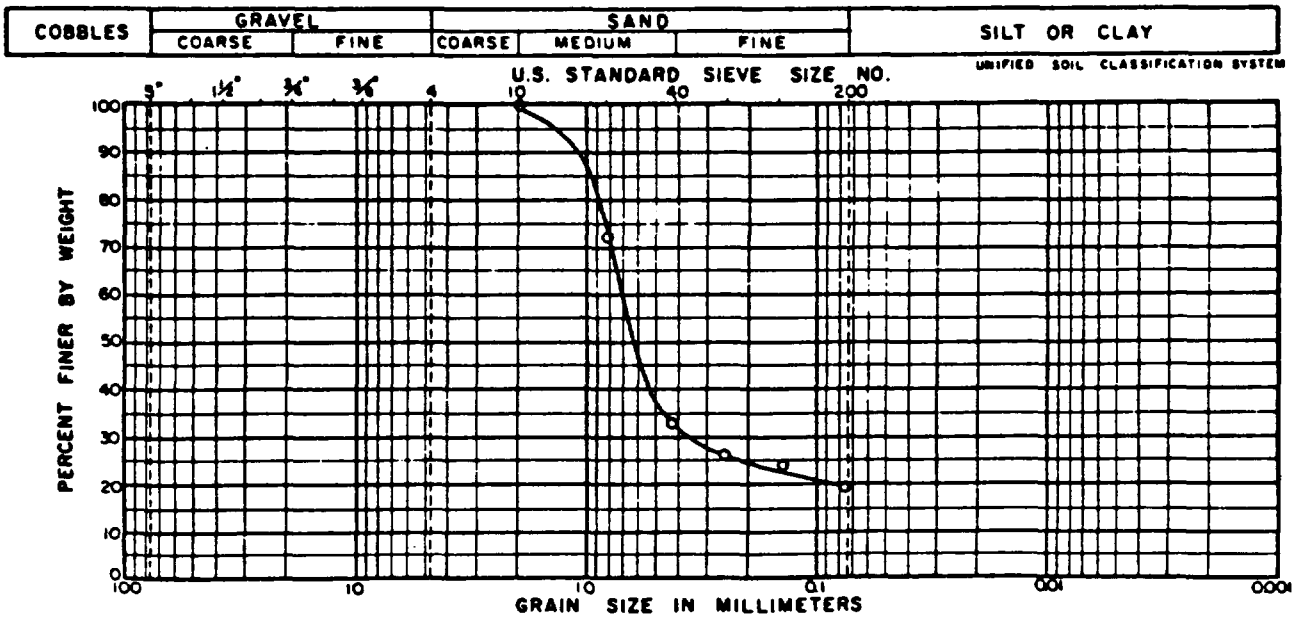
MECHANICAL ANALYSIS



UNIFIED SOIL CLASSIFICATION SYSTEM

BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
B-50	S-5	14.0-15.5	○	Dark gray micaceous medium to fine sandy silty clay.	44.1	105	59
B-50	S-6	19.0-20.5	●	Tan silty clayey medium to fine sand.	21.2	84	39



UNIFIED SOIL CLASSIFICATION SYSTEM

BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
B-50	S-7	24.0-25.5	○	Dark gray micaceous silty clayey medium to fine sand.	21.6		

JOB NO. 7-77

B-20

APPENDIX

C

GUIDE SPECIFICATIONS FOR ON-GRADE COMPACTION

1. EQUIPMENT

The designated subgrade area shall be rolled with a heavy-duty pneumatic tire roller as directed by the Engineer. Approved pneumatic tire equipment for rolling shall be of such capacity that the load may be varied from no more than 15 to not less than 50 tons. This load shall be transmitted through axles acting in a line perpendicular to the centerline of the roller to permit oscillating action. The total axle load shall be transmitted to the ground on not more than four pneumatic tires. Rollers which permit the individual oscillation of each tire under a proportionally maintained load will also be acceptable. Tire inflation pressure shall be adjusted so as to permit roller operations with tire pressures as low as 50 pounds and as high as 120 pounds per square inch.

2. OPTIONAL EQUIPMENT

Under applicable soil conditions, the use of heavy-duty vibratory rollers will be permitted subsequent to the written approval of the Engineer. Such equipment shall consist of a vibratory smooth wheel compactor with a fully ballasted static weight of not less than 140 pounds per inch of roller width.

3. COMPACTION

The rolling shall cover the entire subgrade area as delineated by the pertinent Plans and Specifications. Initial compaction shall be accomplished with an axle load as directed by the Engineer. When stability is achieved under the first stage rolling,

the axle load shall then be increased in stages, if necessary, to a total load of not less than 50 tons. Final rolling shall be done with the maximum axle load. This rolling shall be continued until the degree of foundation stability, as required by the Engineer, has been obtained. In rolling, one pass shall be taken to represent two trips of the roller, each trip off-set from the other by the width of one tire to obtain complete area coverage.

As the rolling progresses, the irregularities between tire marks shall be leveled off to facilitate compaction and to permit complete area coverage by the tire. All local depressions which interfere with the rolling operations shall be leveled as directed by the Engineer. When the subgrade condition is satisfactory for normal rolling, the speed of the roller shall not be less than 2-1/2 miles per hour.

4. PAYMENT

The quantity to be paid for under this item shall be the number of hours of rolling performed by the special rolling equipment. No payment will be made for idle equipment due to repairs, bad weather, wet subgrade, or for any other reason. The time of rolling shall be recorded by the Contractor. This time shall be checked daily by the Engineer. The unit price bid for this item shall include the cost of furnishing all labor, materials, fuel, equipment and repairs necessary to complete the work.

APPENDIX

D

GUIDE SPECIFICATIONS FOR LOAD BEARING FILL

The guide specifications outlined herein are suggested for use in contracts which involve placement of load bearing fill. It is intended that they be incorporated into the General Contract and that appropriate sections be used in subcontracts for Earthworks, Foundations, Site Utilities, or any other subcontract which involves the use of fill for support of settlement sensitive facilities.

1. GENERAL

1.01 Scope: This contract involves the construction of controlled earth fills to support structural elements (building floors, interior footings, exterior footings, etc.), utilities, roadways or any facility which the instability thereof would impair the intended usage. The specifications which follow are intended to insure that all such fill supported facilities as delineated by the plans and specifications will be stable and free of objectionable settlements.

1.02 Exception: Adherence to these specifications is mandatory. No deviation will be permitted except with the written approval of the Engineer.

2. THE ENGINEER

2.01 Definition: The Owner's representative for control of subgrade preparation and placement of all load bearing fill will be henceforth known as the Engineer. The Owner will designate in writing to the Contractor the person or organization that is to serve as the Engineer.

2.02 Duties: The Engineer will approve or disapprove fill materials, make appropriate tests, pass or reject compacted fill, and designate for removal any unsuitable materials which may remain at the bottom of the excavated area after the limits for the excavation designated in the plans have been reached.

2.03 Compliance: The Contractor is to comply with the instructions of the Engineer concerning the work described above and shall cooperate with the Engineer in his performance of his duties.

3. SUBGRADE PREPARATION

3.01 Stripping: All portions of the area to be filled shall be stripped of vegetation, roots, organic soil, peat, trash, or other materials designated by the Engineer as deleterious. Stripped material shall be hauled away and wasted or stockpiled on the site for use in final grading and landscaping, as directed by the Engineer.

3.02 Excavation Below Subgrade: The Contractor shall remove and replace with compacted fill any subgrade material which is designated by the Engineer as unsuitable. Compaction of the fill placed in such areas will conform to the requirements for fill Placement and Compaction in Section 5 below.

3.03 Transition Areas: Cut and at-grade sections adjacent to the fill and carrying loads similar to those carried by the fill shall be scarified to a depth of six inches and shall be compacted to a degree equal to that of the overlying fill.

4. TYPE OF FILL

4.01 Material: The fill shall consist of materials conforming in quality and gradation to the following criteria (a). No organic inclusions, frozen materials, ice, snow, or any material which by decay or other means might cause settlement shall be placed or allowed to remain in the compacted fill area.

(a) In accordance with the accompanying recommended design criteria.

4.02 Sampling: Prior to stockpiling or placing any imported fill materials on the job site, the Contractor will submit to the Engineer for his approval approximately one hundred pound samples representative of the fill at the proposed borrow source. The Contractor shall also prove, to the satisfaction of the Engineer, the availability of the required fill quantities at any proposed borrow source.

5. PLACEMENT AND COMPACTION

5.01 Pre-Inspection: Before fill operations are started, the Engineer will inspect the subgrade and will direct the Contractor to remove any remaining undesirable subgrade materials. Ice, snow, and frozen subsoils shall be stripped prior to the fill operations.

5.02 Compaction Equipment: Prior to the initiation of work, the Contractor shall submit to the Engineer, for his approval, a list of the proposed compaction equipment including the manufacturer's specifications for each proposed compactor. Generally, steel wheel or pneumatic tire rollers with either a static and/or vibratory loading are desirable for the compaction of predominantly granular soils. The use of "sheeps foot" or tamping rollers should be limited to the compaction of fine grained plastic soils.

5.03 Fill Lifts: All load bearing fill shall be placed in approximately horizontal lifts not exceeding eight inches in loose thickness. So far as practical, each layer of material shall extend the entire length and width of the area being filled. Before compaction is started, the material shall be leveled by means of bulldozers, blade graders, or other equipment approved by the Engineer. The use of dragline excavators or similar equipment which excavate and deposit material in large unit masses will not be permitted, unless all materials excavated in this manner are spread in the manner and to the thickness specified herein.

5.04 Moisture Content: The moisture content of the fill shall be reduced or increased by uniform sprinkling, as necessary, to achieve the specified degree of compaction. Fill shall not be placed in water, except as specified by the Engineer.

5.05 Disking and Scarifying: Each layer of fill shall be disked sufficiently to break down oversized clods, to thoroughly mix non-uniform materials, to secure a relatively uniform moisture content, and to insure uniform density and proper compaction. Disking may be omitted if the fill consists of predominantly granular materials.

5.06 Surface Drainage: The fill surface slope shall be maintained to facilitate surface run-off away from the load bearing fill and to prevent ponding of surface water. During periods of anticipated inclement weather, the surface of the fill shall be graded and sealed as directed by the Engineer to preclude percolation of surface water. If ponding of surface water does occur, it shall be removed by pumping, ditching, or as otherwise directed by the Engineer.

5.07 Compaction: The method of compaction shall be such as to secure a density of not less than (a) per cent of the maximum Modified Density as defined by ASTM Designation D1557-70. The Engineer shall be the sole judge as to when the density required herein has been obtained.

5.08 Testing: Density checks will be made by, or under the direction of, the Engineer to determine the adequacy of compaction. The location and frequency of such field tests shall be made at the Engineer's discretion, except that there shall be not less than one such test for each 40,000 square feet on alternate lifts.

5.09 Unsatisfactory Compaction: The Contractor will be directed by the Engineer to correct, at his own expense, any areas of unsatisfactory compaction by removal and

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(a) In accordance with the accompanying recommended design criteria.

replacement or by scarifying, aerating, or sprinkling (as needed), and recompaction in-place prior to placement of a new lift.

5.10 Backfill in Limited Areas: Backfilling shall consist of placing and compacting the necessary fill within the space excavated for footings, walls, utility trenches, and other limited areas where large compaction equipment cannot work. Fill in such areas must be spread in thin lifts, not exceeding eight inches in loose thickness, and shall be compacted with small hand manipulated machines such as pneumatic tampers, vibratory compactors, etc. Because of the difficulty in obtaining the specified densities under these conditions, it is desirable to use granular or lean concrete backfill in these areas. Backfill materials shall meet all the requirements specified in Paragraph 4.01 for regular fills.

6. PROTECTION OF WALLS AND PIERS

6.01 Backfill: In placing backfill, the material shall be placed simultaneously, insofar as possible, to approximately the same elevation on both sides of a wall, pier, or column. If conditions require placing backfill appreciably higher on one side of a wall, pier, or column than on the opposite side, the unbalanced fill shall not be placed until test specimens show that the concrete has attained a modulus of rupture of at least 650 psi, but in no case until at least seven days have elapsed after the placing of the concrete, unless authorized by the Architect.

No fill shall be placed or compacted over or against concrete footings, columns, or walls until the concrete has set sufficiently to withstand the weight and pressure of the fill and the vibration or impact forces transmitted from the compacting equipment.

6.02 Bracing: Temporary bracing of a wall, pier, or column to withstand unbalanced lateral fill pressures shall be permitted only upon the written approval of the Architect, subsequent to review of the proposed bracing scheme.

APPENDIX

E

TECHNICAL SPECIFICATIONS
FOR
REFUSE FILL CONSTRUCTION

The technical specifications outlined herein are suggested for contracts that involve the disruption of an existing refuse dump. It is intended that they be incorporated into the general contracts and that appropriate sections be used in subcontracts for Earthworks, Foundations, Site Utilities or other subcontracts that involve excavation into or placement of refuse materials.

1. GENERAL

1.01 Scope

This contract involves the excavation of refuse materials from designated areas and the placement of these refuse materials into other designated areas so as to achieve the design lines and grades of the proposed site development. Also, included within these specifications are any other excavations or grading activities involving existing or recently placed refuse materials. The specifications which follow are intended to insure that all such site development work involving refuse materials will be performed in a manner that will preclude health or safety hazards, minimize environmental disruption during such activities, and produce a completed subgrade suitable for the support of parking facilities.

1.02 Exception

Adherence to these specifications is mandatory. No deviation will be permitted except with the written approval of the Engineer.

2. THE ENGINEER

2.01 Definition

The Owner's representative for control of the subgrade preparation, excavation and placement of all refuse materials will henceforth be known as the Engineer. The Owner will designate in writing to the Contractor the person or organization that is to serve as the Engineer.

2.02 Duties

The Engineer will approve or disapprove construction procedures, make appropriate tests, pass or reject compacted fill and designate any areas of the site requiring further treatment in accordance with these specifications.

2.03 Compliance

The Contractor is to comply with the instructions of the Engineer concerning the work described above and should cooperate with the Engineer in the performance of his duties.

3. HEALTH AND SAFETY

The Contractor shall observe the following requirements to protect the health and safety of persons on and near to the construction site.

3.01 Fire Prevention

Smoking, open fires, or equipment producing flames, electrical sparks or heat sources in contact with the ground are prohibited from areas of the site containing refuse materials. The Contractor shall post appropriate warning signs and shall supervise the working force in the compliance of this regulation. Fueling or servicing of the construction equipment shall be performed in areas of the site that are not occupied by refuse materials as approved by the Engineer.

3.02 Fire Control

The Contractor shall provide for a fire fighting capability at the site if required by the local Fire Department. The Contractor shall immediately notify the Engineer and the Owner of any smoking, smoldering, or burning refuse materials and the Contractor shall immediately extinguish any smoking, smoldering or burning refuse materials. If any smoking, smoldering or burning persists for longer than 24 hours, the Contractor, at his own expense, shall seek and obtain fire fighting assistance. The Contractor shall also be responsible for fire control during weekend, holiday, and other periods when general construction activity is not in progress. The placing of refuse materials in the vicinity of fire fighting activities is prohibited.

3.03 Dust and Debris Control

Dust control, such as water sprinkling or chemical treatment of haul roads and other dust producing areas, shall be effectively implemented by the Contractor as required. The Contractor shall control scattering of papers and other light-weight materials from the refuse fill by the use of movable fencing and/or other effective means.

3.04 Insect and Rodent Control

The Contractor shall cooperate at all times with the insect and rodent control program being maintained by the Owner. The Contractor shall periodically notify the Engineer and the Owner of the planned future construction activities so that the insect and rodent control program may be properly coordinated.

3.05 Leachate Control

Groundwater or surface water that has been in contact with refuse fill materials is defined as leachate. The Contractor shall provide

the temporary collection and drainage systems to prevent leachate from entering into the surface waters on the site. Leachate thus collected shall be conducted to a central location and disposed of as shown on the appropriate Contract Drawings. Permanent leachate control measures shown on the Contract Drawings shall be constructed as the site grading proceeds.

3.06 Gas Control

The Contractor shall install the permanent gas control measures shown on the Contract Drawings as the site grading proceeds.

4. SUBGRADE PREPARATION

Subgrade preparation for refuse fill placement shall be performed in accordance with the following sections.

4.01 Stripping

Designated areas of the site to be excavated for soil borrow and subsequently filled with refuse materials shall be stripped of all vegetation, roots, organic soil, peat, trash or other materials designated by the Engineer as deleterious. Designated portions of the site for the placement of refuse fill materials shall be cleared of trees and heavy brush. Stripped materials shall be placed in designated areas for refuse materials. Suitable topsoil materials shall be stockpiled on the site in manners approved by the Engineer for use in final grading and landscaping.

4.02 Subsurface Drainage

After stripping and excavation, subsurface drainage systems for groundwater control or leachate collection should be installed as shown on the Contract Drawings.

4.03 Subgrade Compaction

Exposed existing refuse materials in the areas to receive additional refuse fill should be compacted on grade by six (6) passes of an approved roller in accordance with Section 5.03. Areas of unstable refuse fill should be compacted on grade with additional roller passes as directed by the Engineer.

5. EXCAVATION AND PLACEMENT

The Contractor shall excavate and place refuse fill materials in accordance with the following specifications.

5.01 Pre-Inspection

Before excavation and placement operations are started, the Engineer will inspect the subgrade and will direct the Contractor to remove any remaining undesirable subgrade materials or to perform additional subgrade preparation. Excessive ice, snow, frozen subsoils and ponded water shall be removed prior to the refuse fill placement operations as directed by the Engineer.

5.02 Working Face

Those portions of the site where the Contractor is operating sufficient equipment, as determined by the Engineer, to properly and effectively excavate or place refuse materials are defined as working faces. The Contractor shall coordinate the construction activity such that the area of a working face shall not exceed 15,000 square feet of exposed refuse materials.

5.03 Compaction Equipment

Prior to the initiation of work, the Contractor shall submit to the Engineer for his approval a list of the proposed compaction equipment including the manufacturer's specification for each proposed compactor. Generally, static weight rollers, either pneumatic tire rollers having a minimum ballasted weight of 35 tons or tamping foot compactors such as the Hyster C450A or the Caterpillar 824B, are desirable for compaction of the refuse materials. The effectiveness of other types of rollers shall be demonstrated to the satisfaction of the Engineer before their use will be permitted.

5.04 Fill Materials

It is anticipated that all of the existing refuse materials encountered within the required site excavations may be placed in the designated disposal areas. Any over-sized particles that are encountered, such as tree trunks, demolition rubble, or household appliances, shall be broken or crushed to reduce any void spaces. These large particles shall then be placed in the deepest portions of the required refuse fills and thoroughly surrounded by well compacted refuse fill as directed by the Engineer. Refuse materials whose constituency or moisture content precludes efficient quality compaction shall be blended with other site materials or otherwise treated as directed by the Engineer so that quality compaction may be obtained.

5.05 Fill Lifts

All refuse materials shall be placed in approximately horizontal lifts not exceeding two feet in loose thickness. So far as practical, each layer of material shall extend the entire length or width of the working face.

Before compaction is started, the materials shall be leveled by means of bulldozers, blade graders, or other equipment approved by the Engineer. The use of dragline excavators, dump trucks or similar equipment which excavate or deposit material in large unit masses will not be permitted unless all materials excavated and deposited in this manner are spread as specified herein.

5.06 Compaction

After placing and spreading, each fill lift of refuse materials shall be compacted by successive passes of an approved compactor. Such compaction shall continue until the non-recoverable compression of the refuse fill materials is negligible as determined by the Engineer. It is estimated that a minimum of four (4) and a maximum of eight (8) complete coverages will be required to compact the refuse materials. A test fill program will enable a determination of the number of coverages necessary with the compaction equipment being used. The Engineer shall be the sole judge as to when the density required herein has been obtained.

5.07 Soil Cover

Temporary soil cover at least six inches thick shall be placed over all working faces when construction activity will not resume within 24 hours. Temporary soil cover shall be placed at other times where undecomposed refuse materials are exposed, as directed by the Engineer. Intermediate soil cover at least one foot thick shall be placed over all working faces that are brought to finished line and grade. Soil cover shall consist of inert inorganic soil excavated from the site or other inert inorganic material as approved by the Engineer.

5.08 Unsatisfactory Construction

The Contractor will be directed by the Engineer to correct, at his own expense, any areas of unsatisfactory construction by performing the necessary additional construction.

5.09 Surface Drainage

Surface grades during construction shall be maintained to facilitate rainfall runoff away from working faces and to prevent ponding of surface water. Where the refuse fill has been brought to finished grade and the intermediate soil cover placed, the surface drainage should be maintained such that rainfall runoff is directed away from the leachate collection system. Surface water and rainwater that contact refuse materials shall be treated as leachate and handled and disposed of properly in accordance with Section 3.05. Rainfall runoff that does contact refuse materials may be disposed of through the surface drainage from the site.